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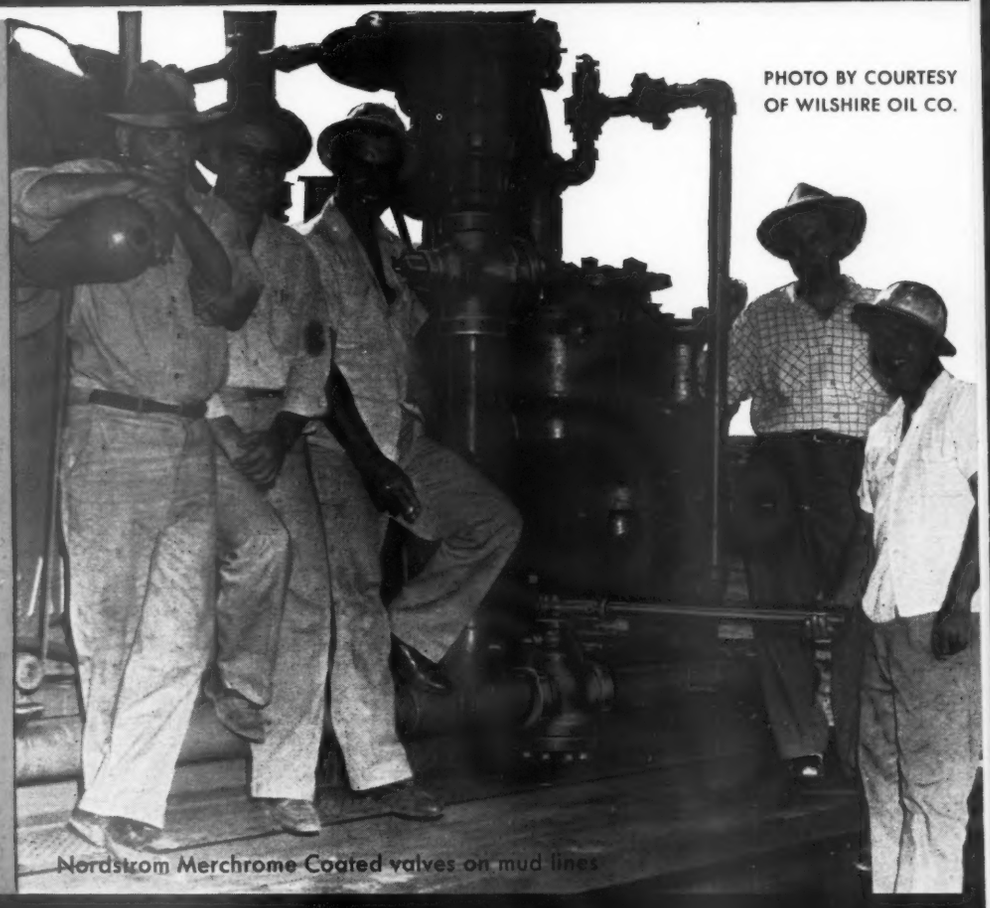

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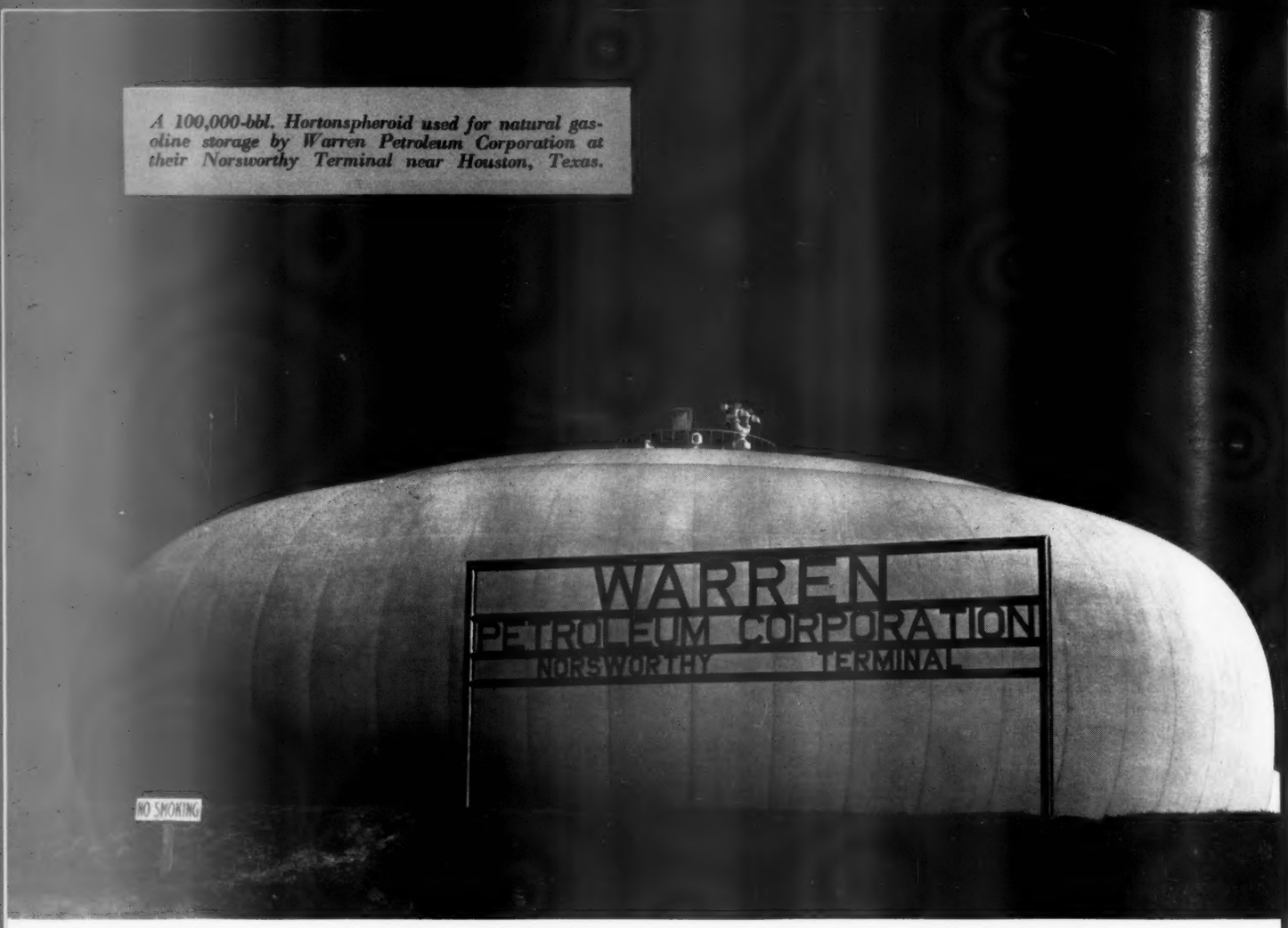

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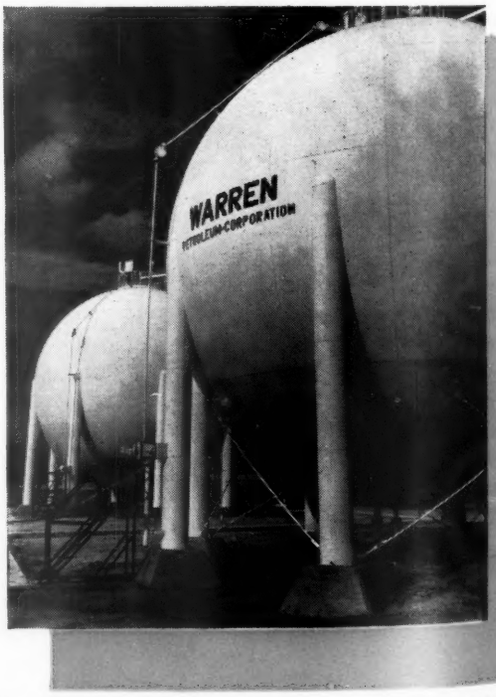

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the Course of OIL

A Reassuring Appraisal

At this writing, production and refining of oil in Iran have come to a standstill. Resumption of operations may be a long way off. When they are resumed, the world oil picture will have undergone a change that may be far-reaching in its implications. Our ideas regarding the availability of oil to the free nations of the world may, therefore, have to be revised. No matter the outcome, the trend of world events bids us look to our own oil and gas resources and appraise their availability in the immediate years ahead, taking into account contingencies as well as every day domestic needs.

It is estimated by the National Petroleum Council's Committee on Oil and Gas Availability that in January of this year the availability of oil in the United States was 7,300,000 barrels a day. This was 835,000 barrels a day more than the actual daily average production (6,465,000 barrels) during that month. Availability as applied to oil and gas here refers to crude oil and gas that is on tap for immediate use or delivery if needed, to sources of supply already developed.

In estimating the availability figures for oil and gas for the next five years, 1951 through 1955, it was assumed that adequate steel supplies would be available and maximum efficient rates of production maintained. It is estimated that by 1955 availability in the United States can be increased to 7,800,000 or 8,800,000 barrels a day for crude oil and natural gas liquids. Compared with a production of 5,900,000 barrels a day in 1950, this is an increase of between 32 and 49 per cent over a five-year period. Similarly, it is estimated that the availability of natural gas by 1955 can be increased to 9.5 to 11.9 trillion cubic feet, or some 38 or 72 per cent more than the actual production of 6.9 trillion cubic feet in 1950.

Estimates of availability of oil were made by this Committee in 1948. They proved to be quite conservative, for the availability in January 1951 actually was greater by 525,000 to 915,000 barrels a day than was estimated about three years before. The figures worked up by this committee are the most reliable of their kind. For each district the figures were obtained through surveys made by local persons thoroughly conversant with the local industry in which they worked. These latest figures are, if anything, even more conservative than previous estimates.

Even without the potential yield of oil and gas that could be developed from oil shale and other sources in case of dire necessity, domestic available oil and gas resources are adequate for the next five years. It is reassuring to observe that the trend of this adequacy is upward. There is no evidence to indicate that the trend of adequacy to meet our probable needs will be downward.—K. C. S.

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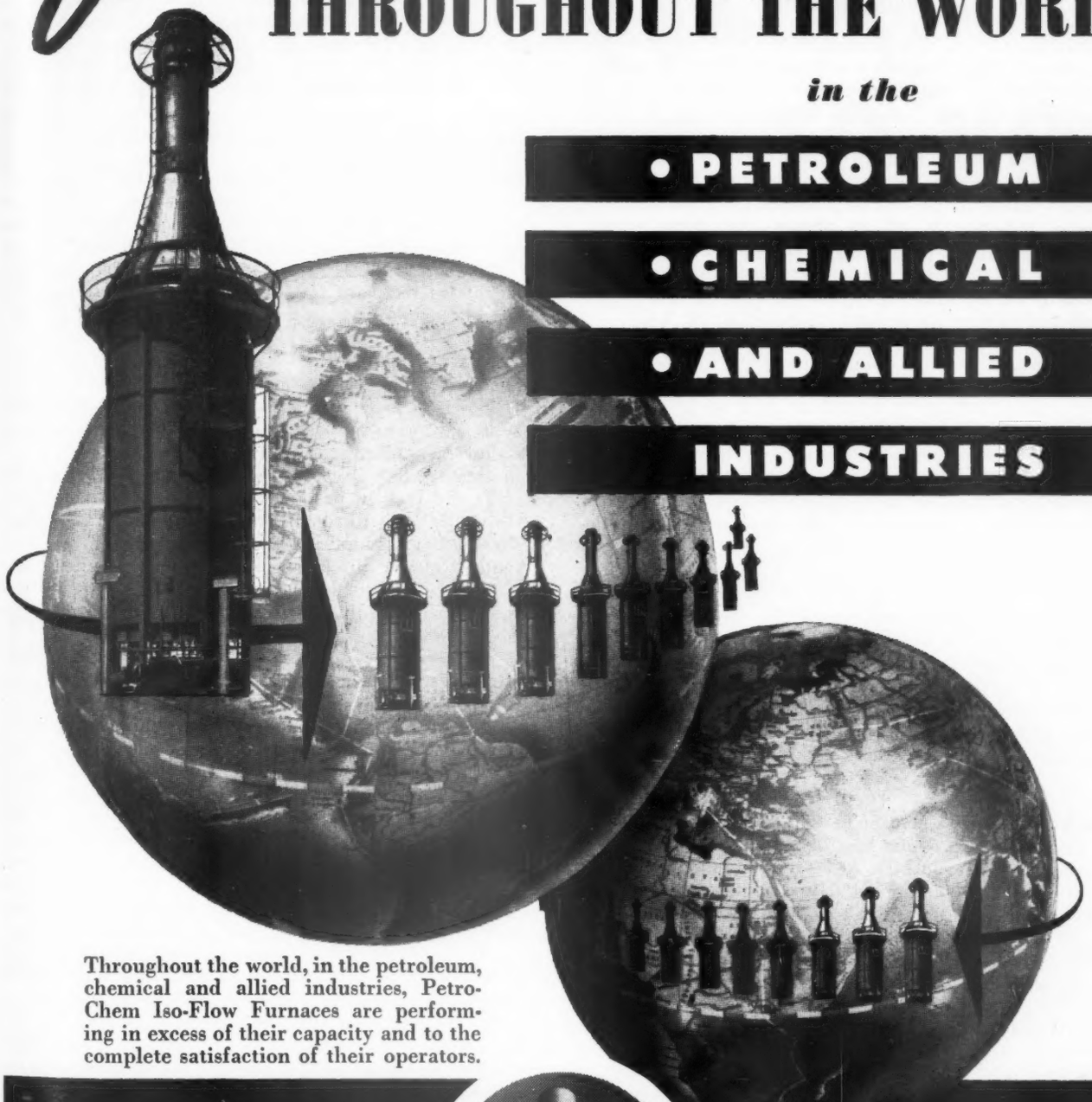

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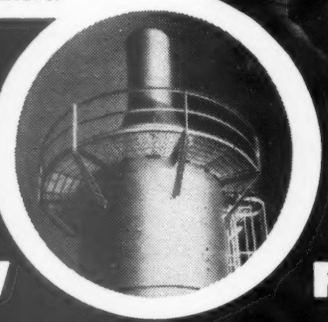

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Scanning WASHINGTON'S OIL HORIZON

By Milburn Petty

WASHINGTON — The Iranian trouble, by dramatizing the danger of depending on too-distant sources of supply, has underlined the importance of finding and developing more oil in the United States and elsewhere in the Western Hemisphere.

Top leaders in the Truman Administration and in the Congress have become oil conscious again. The threat of rationing—unless more steel is provided for expanding the petroleum industry in all its phases—has been voiced, loudly. Result is that more steel likely will be made available for the fourth quarter. There are signs that some sort of tidelands leasing bill may be enacted this year. And there is intensified interest in nearby foreign oil areas.

▸ **Expansion.** A turning point in the fight for more steel came with issuance of the quarterly report by Mobilization Czar Charles E. Wilson. In it, Wilson cited the Middle East troubles as emphasizing the urgency of expanding domestic oil capacity, including the addition of another million barrels daily to refining capacity. Wilson's subordinates in the Defense Production Administration will find it difficult, in the face of this report, to deny the steel needed for this urgent program.

▸ **Steel Quota.** The protests which followed DPA's allocation of only 1,583,800 tons of steel for oil and gas in the third quarter (67 per cent of the amount requested by the Petroleum Administration for Defense) seem to be bearing fruit. Before the outcry had started, DPA had set the fourth quota tentatively at 1,500,000 tons. But this recommendation was increased to 1,862,000 tons later. And it may go still higher, approaching the 2,135,000 tons requested by PAD.

▸ **Gas Ban.** Lack of line pipe to complete needed transmission projects by next winter has forced PAD to clamp down on expansion of gas markets. At first, it was announced that no natural gas could be supplied to new installations of space heaters anywhere in the United States with exemptions promised for areas where distributors could show that their supplies would meet estimated demands. Within a week, PAD had pulled in its horns, confining the proposed ban to East of the Mississippi River except for some isolated areas. Other relaxations were not long in coming. Meanwhile, some oil leaders criticized the proposed order, saying it might lead to "end use" controls on oil and gas, permanently.

▸ **Phillips Case.** Independent producers will be freed of the threat of regulation by the Federal Power Commission if the Supreme Court upholds the FPC's 4-to-1 decision that it does not have jurisdiction over Phillips Petroleum Company. The FPC said, in effect, that it does not have control over arm's length sales by independent producers and gatherers of gas. Complainants in Michigan and Wisconsin had asked the FPC to reduce gas prices that Phillips charged pipe lines serving them. Critical columnists are saying this "nullifies" the Kerr Gas Bill veto.

▸ **Alkylation.** PAD is putting on pressure to get more alkylation units included in construction programs, taking into account the size and adaptability of each project as well as the company's size and financial resources. With every project—now under way or planned—needing materials, PAD's authority to grant or withhold priorities assistance provides the means of "persuading" any company to alter its building plans so as to include a much-needed alkylation unit. It can be expected that PAD will only ask the large companies to do this. Of course, if any small company is willing and able to include such a unit in its program, PAD would welcome it and provide every possible help. PAD realizes the need for not letting the small company share of total refining capacity shrink during the mobilization period.

▸ **Iran.** The reason why PAD did not want the Texas allowable raised for August was that this provided a better lever for getting approval of proposed "pooling" arrangements to maintain the world oil supply in spite of the Iranian difficulties. Department of Justice has been somewhat less than eager to clear the plans for joint action being developed by PAD's Foreign Petroleum Supply Committee.

▸ **Price Controls.** While the Office of Price Stabilization was marking time, waiting to learn its fate from Congress, the OPS petroleum branch was discussing with PAD officials possible ways of using price controls to increase supplies in case shortages develop.

On idea was that a price formula could be worked out for gasoline and fuel oil designed to encourage refiners to increase yields of distillate fuel oils. Some means of increasing residual fuel supplies are also being sought.

Another matter discussed was compensation for using high cost substitute methods of transportation in areas where ordinary transportation facilities become overtaxed. Such a plan was developed and used during World War II.

▸ **Tidelands.** Two factors are working in favor of a compromise tidelands leasing bill. First, top officials realize that they can't force an outright federal control bill through Congress. Second, many former advocates of outright quitclaim legislation have become convinced that President Truman's veto would be upheld. So, why waste time trying either type of bill when tidelands oil development is so urgently needed.

A step in the direction of compromise legislation was the Walter Bill developed in the House. It would confirm federal title to lands outside the three-mile limit (10½ miles for Texas) and provide for federal leasing—with adjoining states sharing in the royalties—of this area, which represents 90 per cent of the Continental Shelf. Within the marginal belt, traditionally regarded as belonging to the adjoining states, the bill would confirm the title of these states.

▸ **Coal vs Oil and Gas.** The coal industry is suspicious that PAD's proposed ban on new gas installations, with the blame laid on lack of line pipe, is just a move "to pry loose more steel for the building of gas pipe lines."

Meanwhile, a leading spokesman for the coal industry, Joseph Pursglove, Jr., of Pittsburgh, waxes optimistic with the prediction that King Coal is due to make a comeback because of rising costs of finding and developing oil in the United States, adding, "The day when Americans can produce cheap oil in foreign lands is about over." By 1955, Pursglove says, "the pickings will be leaner" on gas so that the huge financial backing will no longer be available.

▸ **Mexico.** Secretary Chapman's visit to Mexico is just the first of several he plans to make to other oil countries in the Western Hemisphere. Next, he will visit Canada. He hopes to make the North American continent self-sufficient on oil, providing the steel and other help needed to increase the productive capacities of our neighbors. Inevitably, his trip brings up the question of whether the Mexican oil loan issue is about to be revived.

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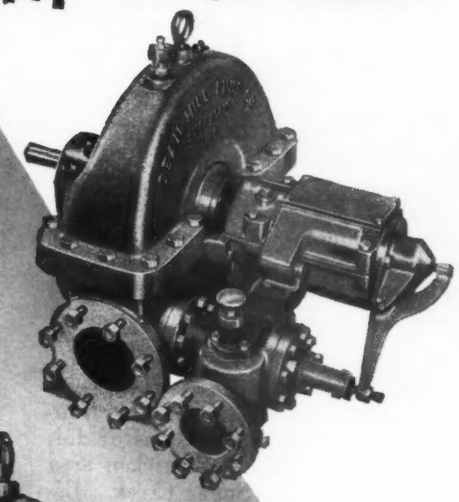

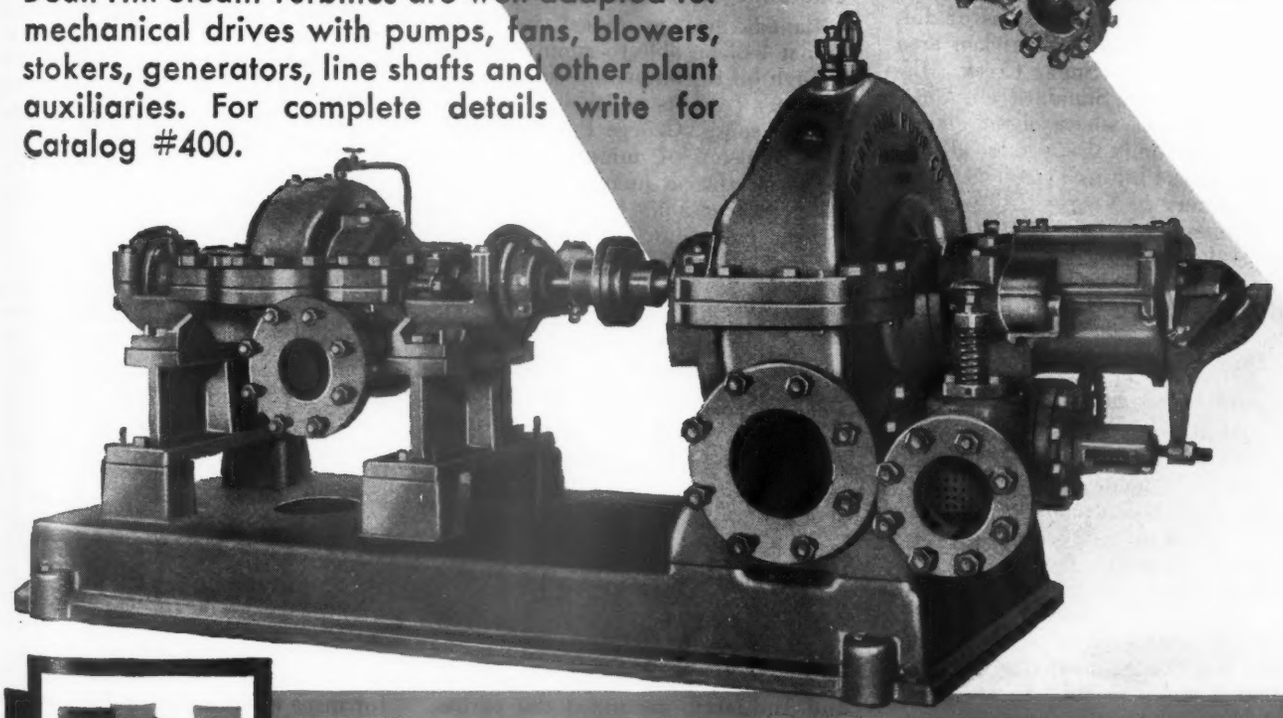

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HIGHLIGHTS IN OILDOM

"TARGET FOR TERMITES"

Benjamin F. Fairless, president of United States Steel Corporation, says that big business is the present "Target for Termites." He writes in SERVICE, Cities Service Publication, that Russia's present object is the destruction of America's industry machines by a Red army of trained termites. It is an article well worth reading.

OIL DEMANDS JUMP

Skyrocketing demands for more oil in the United States will require the oil industry spend $3 billion dollars this year on new construction with an additional $1 billion for replacing present facilities. This is the estimate made by the American Petroleum Institute in a 19-page oil report. Combined civilian and military demand for oil products is expected to jump 8 to 10 per cent this year, in addition to the 12 per cent rise in 1950, API spokesmen revealed.

OIL FIRMS' FLOOD LOSSES MOUNT

A Missouri oil group has estimated the industry's loss in the recent Kansas City flood in the millions of dollars. Supplies from the stricken area came in from the Sugar Creek, Missouri refinery of Standard Oil Company (Indiana) where about 38,000 bbl of crude daily was produced during the time Phillips Petroleum company refinery in Kansas City was out of commission. Phillips lost two bulk plants almost completely, 10 or 11 tanks, and stocks of tires, batteries, and accessories. Numerous other companies lost warehouses, tanks, and stocks.

HOLLAND PLANS OIL EXPLORATION

Claud Barrow has reported in the *Daily Oklahoman* that Holland's Schoonebeek field, on the German border has 113 producers yielding 13,700 bbl of oil a day and is supplying about 23 per cent of the nation's oil requirements. In his report on the trip through Holland at the Third World Petroleum Congress, Barrow added that 6 rigs, 3 capable of going 10,000 ft and 3 to 3000 ft, are being used in an exploration program costing 10,000,000 guilders this year.

NO GAS PRICE LAW IN TEXAS

The Texas legislature adjourned recently without taking any action on the conservation law fixing 11.4 cents a 1000 cu ft as the minimum cost of Texas natural gas production.

HOUSE PASSES TIDELANDS BILL

The House approved state ownership of the tidelands with a 265 to 109 passing of the Gossett-Walter bill. The bill gives Texas title to its tidelands 10½ miles out in the Gulf of Mexico, and other states a 3-mile limit, with 37½ per cent of any royalties taken in by the Federal Government on the Continental Shelf. The bill will be put before the Senate shortly.

MATADOR RANCH SOLD

The big Matador ranch covering hundreds of thousands of acres in the South Plains and Panhandle of West Texas has been sold to a group of Americans. Controlling stock in the land was formerly owned by a group of Scottish financiers, who will retain one-half of the mineral rights. No oil has been found on the ranch lands; however, they are close to oil producing areas, and are under lease. A London banking firm announced that an American syndicate offered $18,960,000 for the Matador Land and Cattle Company.

CANADIAN TAR SANDS SOURCE OF OIL

Canada has expressed its belief that it will be able to supply Britain enough oil to compensate for the loss of Iran's from its undeveloped northern tar sands. George Purdham, federal minister of mines, announced that oil rights of hundreds of square miles could readily be bought by the British, and would be ready for British technicians and equipment to come in and develop the oil rich lands. Along the 100 miles of the Athabaska river's sandy bank, one square mile has been estimated to contain 200,000,000 bbl of oil, equivalent to 10 months' Iranian output.

NO NATIONALIZATION FOR EGYPT

Mohammed Ghannam Bey has spoken out against nationalization of oil in Egypt. In an answer to Mohammed Ahmed Elbidaiwy, who argued for nationalization if the present royalties from the British controlled Anglo-Egyptian Oilfields Ltd. were not increased, the Minister of Commerce and Industry, reminded the parliament that Egypt's oil production was small and that some of it had to be imported. He made one concession, however, in that he agreed that the company would amend its petroleum mining law and make it possible for Egypt to buy its own oil at 10 per cent below world prices.

BRITISH BUYING DOLLAR OIL

Possible loss of Iranian oil production has forced the British to buy American oil with dollars. In addition, the British have stepped up production in other areas, particularly the Middle East, to meet future needs, and to prepare for any emergency. Chancellor of the Exchequer Hugh Gaitskell has estimated that dollar costs of the shift to American oil could reach $350,000,000 a year, a grave threat to Britain's financial situation.

DEPLETION TAX PASSED OVER

Oil men are beginning to hope that maybe *one* of their problems may be working itself out. At least that's the opinion of some of them who noted that the 27½ per cent depletion allowance granted to oil and gas producers was not mentioned by Treasury Secretary John W. Snyder in his report to the Senate Finance Committee. No reference was made to the tax, and no recommendations were made to alter it.

NEW OIL COMPANY PLANNED

Texas congressmen in Washington have hinted that announcement will come shortly of a new independent oil company. The proposed company will be made up of several independent producers in the Southwest, and will seek exploration and development concessions in South America, especially in Venezuela.

GASOLINE TAXES SOAR

A new record was made in April of this year, when gasoline taxes climbed to a level of $17,520,729 for the first four months of the year. This was a 7.1 per cent increase over the like period of 1950, Bureau of Mines figures revealed. In April, alone, the gasoline tax shot up to $45,400,850 — 57 per cent above the corresponding month in 1950. The tax on transportation of oil by pipe line reached $2,025,936, 6.7 per cent more than the $1,897,800 received in April last year.

OIL COMPANY INCOMES UP

The majority of the interim reports for three months ending June 30, this year, and for the first six months of 1951 show oil company incomes far exceeding those of last year. Major companies' reports indicate 1951 total sales will be higher than those for last year, although taxes and increased operating costs may pull net profits lower.

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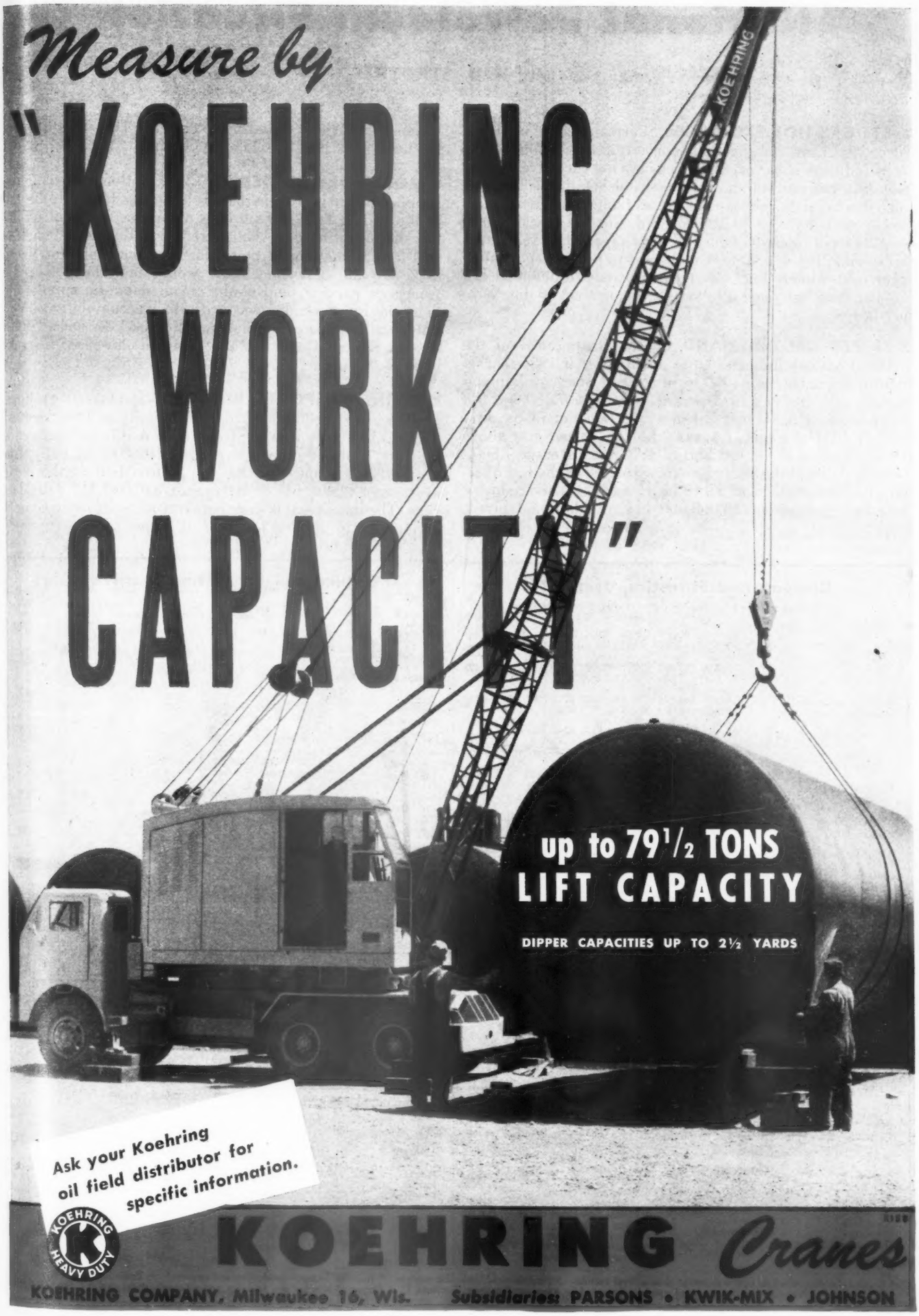

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National Petroleum Situation

By H. J. STRUTH*

STOCKS NOT EXCESSIVE. Sharp increases in stocks of products are causing some concern among refiners. The facts indicate, however, that stocks are not excessive in relationship with current and prospective demand. Stocks of all oils increased 9,500,000 bbl since January 1. Last year, stocks were reduced 44,124,000 bbl. Current stocks represent 84 days supply, against 88 days supply last year. Fuel oil stock-piling is definitely necessary to prevent spot shortages next winter. Fuel oil stocks are only 15,000,000 bbl greater than last year; 49 days supply, against 46 days supply last year.

11 PER CENT DEMAND GAIN. Reappraisal of the demand outlook indicates quite definitely that 1951 market requirements may top 1950 by at least 11 per cent. Demand for all oils this year will probably average 7,580,000 bbl daily, against 6,803,000 bbl in 1950. Demand in the first half of 1951 averaged 7,464,000 bbl, or 13 per cent above 1950. Demand in the last half of 1951 may average 7,600,000 bbl daily. If the heavy demand expected in the last quarter of 1951 is to be met, it will be necessary for the industry to accumulate about 33,000,000 bbl of additional inventories between July 1 and September 30. This should bring the peak stock level to 625,000,000 bbl.

MORE FOREIGN DEMAND. Disruption of petroleum supplies created by the situation in Iran is bound to be felt in the United States. If supplies of products are cut off by the shut-down of the Abadan refinery, European markets will look to the United States for supplemental supplies to make up the deficiency. This would materially increase American exports, and could create domestic supply deficiencies by preventing necessary stock accumulations. Voluntary allocation of surplus supplies in Venezuela, Saudi Arabia, Kuwait, Colombia, and Trinidad may ease the strain upon U. S. supply.

REFINED IMPORTS REDUCED. Imports of refined products averaged about 223,000 bbl daily in June, against 313,000 bbl daily in May. Reports of A.P.I. for week ending July 7, placed refined imports at 192,000 bbl daily. Imports of crude and products in the first half of this year averaged 880,000 bbl daily, against 816,000 bbl daily last year. The increase this year amounts to 8 per cent, against an increase in imports last year of 14 per cent.

*Petroleum Consultant, Dallas, Texas.

Comparative Statistics, June, 1951

*All figures are computed on a Bureau of Mines' Basis**

	June 1951(P)	May 1951(R)	June 1950	This Year to date(P)	Last Year to date	Per cent change
Total supply,* all oils	227,235	235,890	200,720	1,360,580	1,146,234	+19
Daily average	7,574	7,609	6,691	7,517	6,333	
Total demand‡, all oils	211,475	230,084	190,030	1,351,071	1,190,358	+13
Daily average	7,049	7,422	6,334	7,464	6,577	
Change in stocks	+15,760	+5,806	+10,690	+9,509	−44,124	
Crude supply*	202,305	207,970	176,263	1,189,708	997,801	+19
Daily average	6,743	6,709	5,875	6,573	5,513	
Crude demand‡	202,340	202,300	173,853	1,189,356	1,008,870	+18
Daily average	6,745	6,526	5,795	6,571	5,574	
Crude stocks	248,815	248,850	242,287	248,815	242,287	+ 3
Days supply	37	38	42	37	42	
Natural gasoline production	18,220	18,200	14,237	103,823	85,716	+21
Daily average	607	587	475	574	474	
Motor fuel production	95,900	95,800	85,181	550,281	483,998	+14
Daily average	3,197	3,090	2,839	3,040	2,674	
Gasoline yield per cent	43.3	42.2	44.3	42.0	43.5	− 1.5
Motor fuel demand‡	98,860	105,083	92,084	539,678	480,245	+11
Daily average	3,295	3,390	3,069	2,981	2,653	
Motor fuel stocks	126,800	129,750	114,177	126,800	114,177	+11
Days supply	38	38	37	38	37	
Fuel oil production	74,300	76,800	63,170	471,126	384,136	+23
Daily average	2,477	2,477	2,106	2,603	2,122	
Fuel oil demand‡	66,090	75,786	61,499	543,269	487,841	+11
Daily average	2,203	2,445	2,050	3,001	2,695	
Fuel oil stocks	108,300	92,260	93,803	108,300	93,803	+15
Days supply	49	38	46	49	46	
Refinery still runs	198,100	201,750	169,663	1,169,576	981,301	+19
Daily average	6,603	6,508	5,655	6,462	5,422	
Stocks, all oil	592,219	576,459	558,995	592,219	558,995	+ 6
Days supply	84	78	88	84	88	

Current Crude Oil Prices

U. S. average	$2.58	Louisiana	$2.62
Texas	2.61	Arkansas	2.43
California	2.42	New Mexico	2.40
Oklahoma	2.62	Mississippi	2.23
Kansas	2.62	Illinois	2.76
		Other states	2.60

Basic crude prices:

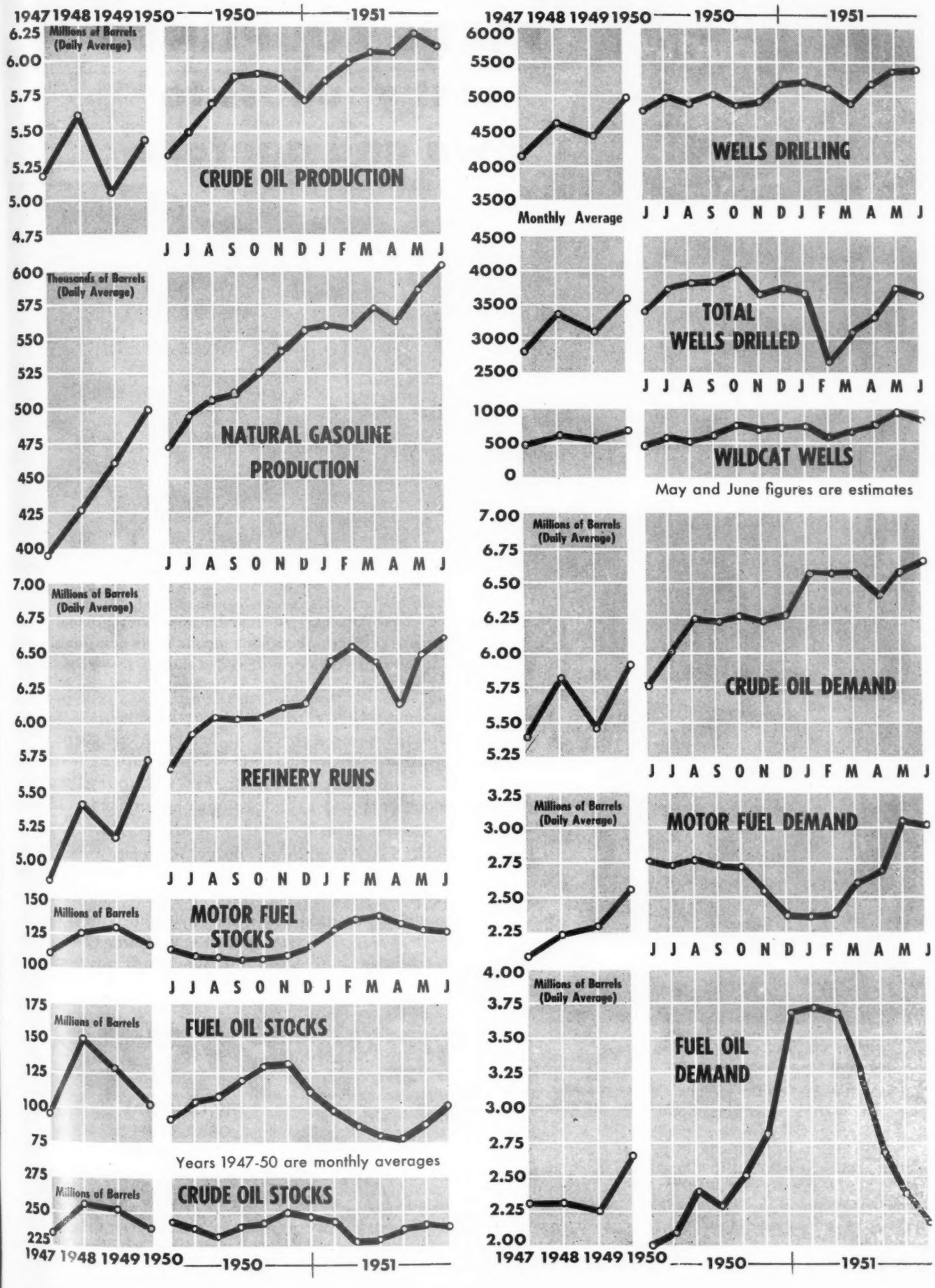
Oklahoma-Kansas (36 gr.)	$2.57
Texas Gulf Coast (36 gr.)	2.80
East Texas	2.65
West Texas (36 gr.)	2.44
California Signal Hill (26 gr.)	2.31
Pennsylvania, Bradford	4.25

Drilling and Production Statistics

	June 1951(P)	May 1951(R)	June 1950	This Year to date(P)	Last Year to date	Per cent change
Wells Drilling	5,355	5,320	5,060	5,355	5,060	+ 6
Total wells drilled	3,674	3,734	3,617	20,142	19,690	+ 2
Development wells	2,780	2,712	2,884	15,270	15,723	− 3
Oil	1,823	1,744	1,966	10,163	10,834	− 6
Gas	229	224	233	1,170	1,211	− 3
Dry	746	739	685	3,937	3,678	+ 7
Per cent dry	26.8	27.2	23.8	25.8	23.4	+ 2.4
Service wells	50	55	50	302	371	−19
Wildcat wells	844	967	683	4,570	3,596	+27
Oil	142	163	104	763	546	+40
Gas	21	32	20	137	102	+34
Dry	681	772	559	3,670	2,948	+24
Per cent dry	80.7	79.8	81.8	80.3	82.0	− 1.7
By State						
Wells drilled (excl service)	3,624	3,679	3,567	19,840	19,319	+ 3
Arkansas	37	23	35	191	190	
California	206	204	148	1,039	837	+24
Illinois	236	195	286	933	1,211	−23
Kansas	370	416	313	2,122	1,730	+23
Louisiana	189	158	187	990	1,172	−15
Mississippi	34	34	29	145	167	−13
New Mexico	51	57	49	307	318	− 3
Oklahoma	411	532	465	2,693	2,534	+ 6
Texas	1,415	1,440	1,383	8,097	7,873	+ 3
Other states	675	620	672	3,317	3,287	+ 1
Wildcats drilled	844	967	683	4,570	3,596	+27
Arkansas	7	8	12	45	52	−13
California	41	39	28	228	184	+24
Illinois	72	70	65	243	300	−19
Kansas	107	113	69	535	333	+61
Louisiana	22	22	17	148	128	+16
Mississippi	12	14	10	62	69	−10
New Mexico	7	10	4	51	38	+34
Oklahoma	68	91	73	479	418	+15
Texas	364	428	265	2,048	1,534	+34
Other states	144	172	140	731	540	+35
Daily crude production	6,171	6,184	5,378	6,063	5,043	+20
Arkansas	79	82	86	81	86	− 6
California	963	961	881	961	866	+11
Illinois	172	162	170	163	170	− 4
Kansas	313	311	302	311	285	+ 9
Louisiana	649	635	568	635	547	+16
Mississippi	102	100	110	102	101	+ 1
New Mexico	144	141	130	141	128	+10
Oklahoma	519	500	454	505	418	+21
Texas	2,779	2,821	2,257	2,704	2,032	+33
Wyoming	187	186	162	188	157	+20
Other states	264	285	258	272	253	+ 8

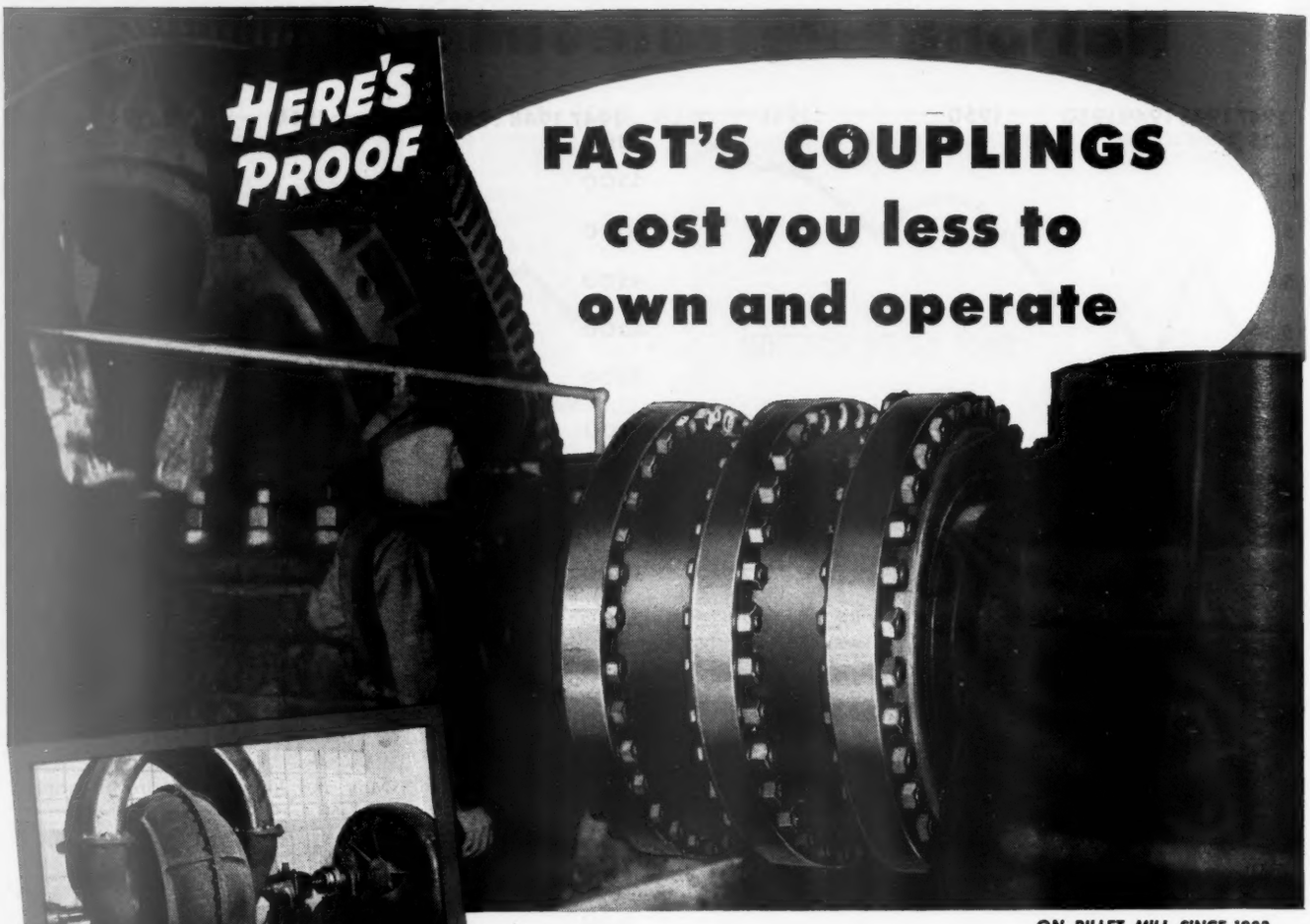
* Unless otherwise stated all figures represent thousands of barrels. ‡ Total demand, including exports. * Includes domestic production and imports. (P) Preliminary. (R) Revised.
Preliminary estimates based upon data supplied by American Petroleum Institute, U. S. Bureau of Mines, State Agencies, and other official sources.

National Petroleum Situation



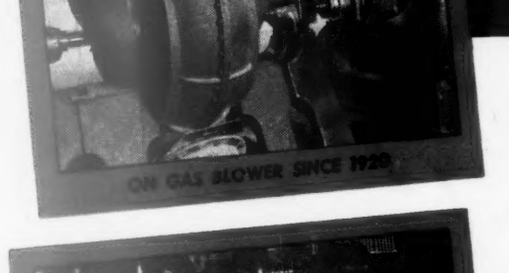
HERE'S PROOF

FAST'S COUPLINGS cost you less to own and operate



ON BILLET MILL SINCE 1923

ON GAS BLOWER SINCE 1920



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INDUSTRY'S STANDARD FOR 31 YEARS

PETROLIC PERSONALITIES

DICK SNEDDON

Potential Sailor Turns Oil Man

Out at the Los Angeles Nomads Whingding a few Saturdays ago at Riviera Country Club we talked briefly but entertainingly with Tom Murray, the ex-Peruvian, whose gaelic accent stirred our slumbering corpuscles into a commendable but futile effort to surge. Tom is a Scot who has adventured far and long in his attempts to make a place for himself in the world and to lay away a hatful of bawbees. He was born in Greenock on the Firth of Clyde where the lure of the sea is as irresistible as an idle slot machine and as strong as the usquebaugh in which the local laddies are wont to bathe their tonsils. It is no wonder then that Tom at a tender age signed up as an able seaman on a tanker bound for Peru. He found that life on the bounding wave wasn't exactly as advertised however, and so when he arrived at his Peruvian destination he promptly jumped ship. He was caught and brought back aboard, and for some hours thereafter, the Captain gave him a pretty thorough going-over, particularly pointing out the seriousness of his offence and the dire punishment normally meted out to deserters.

During this one-sided debate, Tom informed the Captain, in answer to a question, that the main reason for his skipping out was an earnest desire to get work in the oil fields. The Captain, obviously a good egg, thereupon made a pact with him that if he would stick with the ship for three years and generally behave himself, not only would he be forgiven his current misdemeanor but he would be aided in finding an oil job. Tom kept his word, so did the Captain, and at the end of three years Tom Murray's name was duly inscribed on the payroll of International Petroleum.

Meet the Mayor of Negritos

He remained with International in Peru for a total of 39 years and became well and favorably known to every American oil man who ever traveled down his way. He is a real student of human relations with a deep understanding of people and their problems, and he talks Spanish like a native, that is, a native who has been brought up on oatmeal porridge and potato scones. In any case, Tom allowed himself to become completely absorbed into the Peruvian scene and so endeared himself in the process that he was eventually elected Mayor of Negritos, a position he held with distinction for some eight years. As Mayor, it was one of his functions to perform wedding ceremonies and he has united hundreds of young couples in the holy bonds so that he is known to several generations of Peruvians as a sort of padre who is the author of *mucho contentamiente*.

Tom didn't confine his hitching propensities altogether to the native folk, mind you. Many *Americanos* have also been yoked by the Murray marital system. One of the latter was Jack Donovan, a hotshot golfer from down yonder with whom we crossed niblicks at another Nomads Whingding some years ago. To conclude the Murray saga for the moment, although, there is vastly more to tell, Tom retired in 1948 with a 40-year International Petroleum Company service pin in his lapel. He now lives out in Fullerton, California, where he also engages in sundry civic enterprises of which his favorite is a swimming class for young children. He loves this occupation and the kids love him. In fact, Tom is now almost as well known and highly regarded in Fullerton as he was in Negritos a few years ago. He is a stout supporter of Petroleum Production Pioneers and has the time of his life at their gatherings running down his old buddies.

Piscatorial Authorities

We found Tom in a neat little assembly that included Bill Bettis and John Flanagan, M. O. Johnston's popular export team, and two of the sharpest albacore fishermen on the west coast. Bill not only catches fish, he follows them about, studies their habits and haunts, and observes their every movement from the cradle (of the deep, that is), to the gravy. After he has hooked an embarrassed chicken of the sea or two, he dissects them as critically as the coroner does the corpse in a murder mystery, examines their innards with a searching eye and then experiments on various sections of the deceased with bake ovens, stewpots, frying pans, toasters, and other culinary accessories, until he knows exactly how to get the best out of each anatomical area. He knows how to smoke albacore, can it, pickle it, or simply ignore it altogether.

On a deep sea fishing trip he is thus excellent and educational company, besides which, even when he isn't fishing he is right nice people to know. John Flanagan is also a stout man aboard an albacore trawler. Once, indeed, when your correspondent was in grave danger of being yanked overboard by an angry 8-pound yellow-tail, he seized the rod from our trembling hands and before the ill tempered *acanthopterygian* (OK, look it up then if you don't believe it!) quite knew what was happening to him, there he was lying on the deck of our sloop, pouting and panting like a spoiled baby. John is our idea of the perfect host. Every time we see him around the petrolic circuit which is quite often, he is convoying one or more visitors from foreign fields past the dangers and pitfalls of Los Angeles night life. This he does in a gracious, friendly way that we know must be greatly appreciated by his guests.

Purveyors of Close Harmony

Other people of substance at this table were Arnett Norcott, former general manager of International Petroleum Company, still retained by the company in an advisory capacity, and a much admired individual by the equipment people who traveled down in Peru when he was there; Lionel Weidey, member of the board of directors of International, from Toronto, and reported to be going to Miami, Florida, to take charge of things there when the shift is made from Canada; and last but not least, friendly chap by the name of Les Noels who we believe was about to take off for Colombia. At an adjoining table, cutting loose with some mighty fancy harmony were Wendell Jones, the Bethlehem tenor and man about town; By Landis, the Yellow Tiger from the Web Wilson outfit, and a mean exponent of the highland fling; Bill Wilson, vice president of the same institution, guiding light of the Nomads' golf tournament, and proprietor of some of the loudest shirts west of the Rockies; the Van Loozens, major and minor, the former with Ideco, the latter with Web Wilson, and both highly

rated by the petrolic people; Earl Daniels, the Hydril barbecuist whose skill with a skillet is nothing short of amazing. He is also arrangements chairman of the Petroleum Production Pioneers. Anyway, these disciples of euphony were aided in their vocal exercises by a brace of blonde accordionists who certainly made a fine contribution to the total effect, both scenic and musical. The singing may have been deficient in some of the more obscure measures of choral value but one thing it never lacked was volume, and the building tottered dangerously as they sang of their undying affection for Melancholy Baby and pleaded with the Harvest Moon to shine on.

Baker Boys Make Clean-up

Among the several hundred in attendance at this considerable convocation we noted many men of distinction. One of the better performers on the fairway was Tom Bell, The Texas Company production biggie who carried home a trophy of some sort as proof of his prowess. Red Althouse, the Baker Oil Tool engineer, carted off one of the door prizes, making it something like five altogether for the Baker delegation. Pancho Know was another Baker representative who bagged an electric oven or something equally terrific, and Earle Boggess also departed the premises with a crate of stuff that looked expensive.

At the dinner table we sat with George Anderson, the Baker sales chief, recently returned from Europe where he attended the World Oil Congress and had a nice time visiting in Scotland and Ireland. Leo Goss, the Santa Fe Drilling chap sat on our left and wondered how we managed to subsist on so little. In the distance we saw Ray Powell, the Santa Fe Drilling Company's secretary and comptroller and a lad who, besides knowing how to figure the footage cost of a drilling project, has an uncanny yen for the evaluation of aces straights and flushes. Jack Freeman, the Bethlehemite was another golf winner we recognized, and Ralph Clemons, the San Gabriel clubber from the same stable was observed at intervals trying to whip an embryo quartet into action with a little pep talk.

A Case of Mixed Identities

Going back to the Baker roster, we exchanged greetings with R. C. Baker, Jr., in the dining room and judging by what he had in front of him, the jaunt to Europe has in no way affected his customary good health unless perhaps to improve it a little. We had a minute with Ted Sutter, too, as we both started for home about the same time. Ted has just completed a term as prexy of the Petroleum Equipment Suppliers Association, is also recently returned from the World Oil Congress at the Hague, has been involved in an unusual complexity of oil industry committee meetings and government agency consultations, but still looks as placid and undisturbed as ever. 'S amazing!

Shook hands with Joe Pooler and Walt Lundquist, the Pacific Perforating people. For some unknown reason we keep confusing Joe with Ollie Branyon and, by jinks, they are both quite proud of being mistaken for each other. Also had an opportunity to congratulate Roy Johnson, the recently elevated executive vice president of Republic Supply Company, and the Eddie Duchin of the equipment industry. Roy plays bebop and boogie on the piano as expertly as any of the boys on Tin Pan Alley and is a real entertainer when you get him going. He was accompanied by Glen Pitts, another top entertainer from Republic.

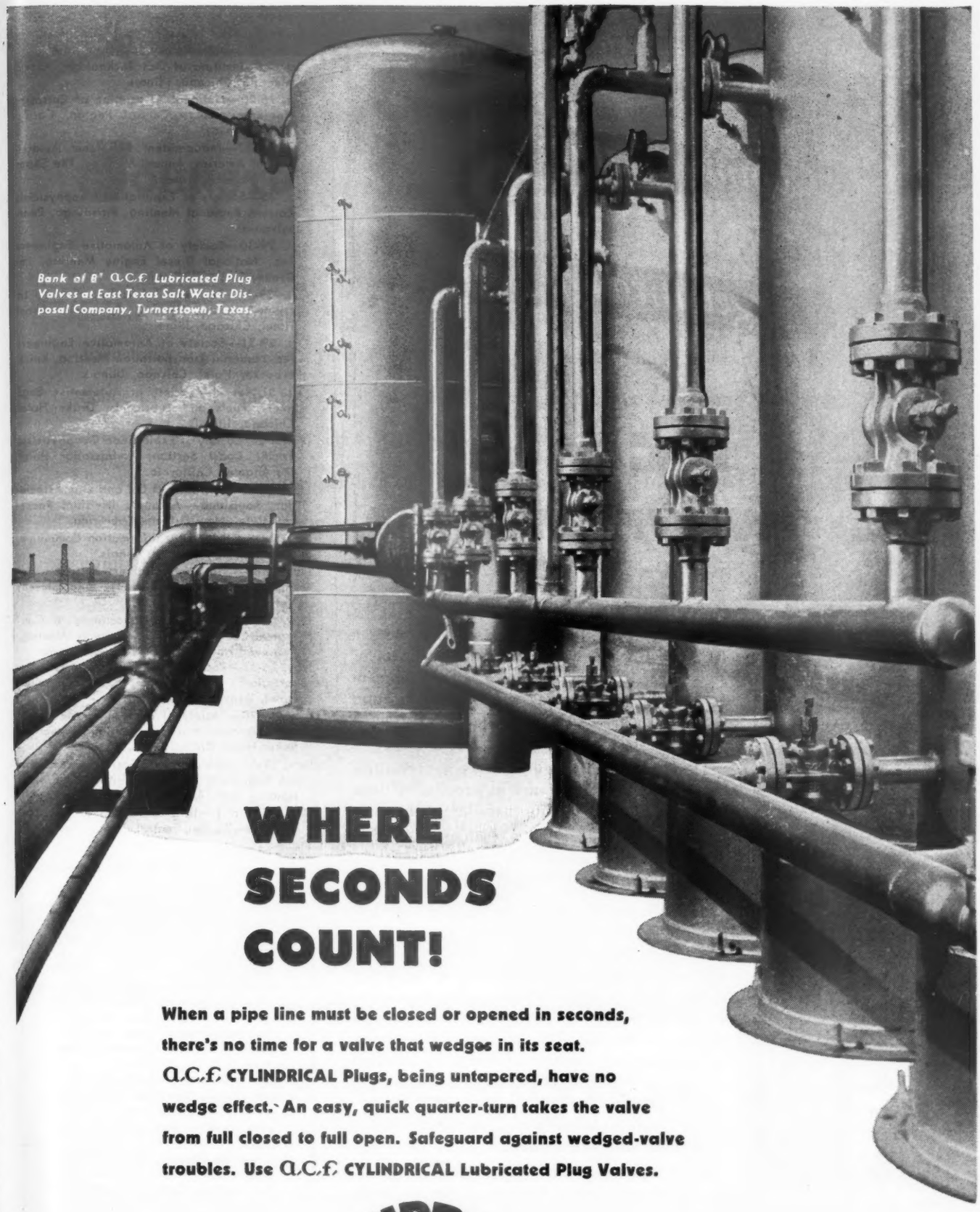
A Polaroid Photographer and Twin Bills

We had hardly set foot in the place before we were shot in cold blood by Ernie Fowks with his polaroid camera, which seemed to be causing a junior sensation among the assembled warriors. After submitting to this ordeal we helped Ernie to pose another pair of gallants, to wit, Elmer Decker, the weight indicator baron, and his guest Bert Eastin. They obediently watched the little mousie and for their pains received a quick print that should look mighty smart in the family album. Seated with an exclusive little group we noted O. W. "Bill" Chonette, The Texas Company Waltonian who has a brother with Shell Company also named Bill.

Then there were the Ideco topshots, John McEwen and Fritz Ripley, a pair of mighty reputable citizens. John has resigned his position as vice president and at the time of this writing was free and untrammelled. He has long been our idea of the thorough gentleman and we are certainly wishing him the most of the best in whatever he may turn to for his future interest and emolument. Fritz is, of course, our domino doubles partner and, although he does say so himself, is one of the better tile tossers of the western hemisphere. Being scientific players, it is just our luck as a rule to be thrown up against a duo that knows nothing of the law of probability, nor of the five multiples, but is simply lucky on the draw, and doesn't have any more sense than to beat us. It's a humiliating business!

A Word of Appreciation

It is really rather dangerous to mention names when discussing an occasion of this sort. So many fine people attend these Nomad Whingdings especially, it isn't fair to name one without naming them all. We certainly would be remiss, however, if we failed to congratulate Jerry Engstrand and his aides and cohorts on one of the best Whingdings of all time. The meal was excellent and Bill Trask staged one of the finest vaudeville shows we have seen in quite a while. Jerry and Bill Wilson officiated very nicely as joint presenters of trophies and the gang was so well behaved you could easily have imagined yourself in church. We would apologize again in concluding for our failure to mention all the good people with whom we consorted. We can right here think of another two dozen or so but space is limited and so we close with our thanks to all the committees and arrangers who assured a good time for the rest of us.



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In Canada: RCA VICTOR Company Limited, Montreal

Engineers, and Society for Non-Destructive Testing, Hotel Statler, Book-Cadillac, and Detroit-Leland, Detroit, Michigan.

Oct. 18—Institute of Gas Technology, Annual Meeting, Chicago, Illinois.

Oct. 18-20—National Association of Corrosion Engineers, South Central Region, Corpus Christi, Texas.

Oct. 22-23—Independent Petroleum Association of America, Annual Meeting, The Shamrock, Houston, Texas.

Oct. 25—Society of Exploration Geophysicists, Eastern Regional Meeting, Pittsburgh, Pennsylvania.

Oct. 29-30—Society of Automotive Engineers, Inc., National Diesel Engine Meeting, The Drake, Chicago, Illinois.

Oct. 29-31—National Lubricating Grease Institute, Annual Meeting, Edgewater Beach Hotel, Chicago, Illinois.

Oct. 29-31—Society of Automotive Engineers, Inc. National Transportation Meeting, Knickerbocker Hotel, Chicago, Illinois.

Oct. 31-Nov. 1—Society of Automotive Engineers, Fuels and Lubricants, Drake Hotel, Chicago, Illionis.

Nov. 1-2—Society of Exploration Geophysicists, Pacific Coast Section, Ambassador Hotel, Los Angeles, California.

Nov. 1-2—Mid-Continent Oil and Gas Association, Louisiana—Arkansas Division, Roosevelt Hotel, New Orleans, Louisiana.

Nov. 3-8—Oil Industry Information Committee, Stevens Hotel, Chicago, Illinois.

Nov. 5-8—American Petroleum Institute, Annual Meeting, Palmer House and Stevens Hotel, Chicago, Illinois.

Nov. 15-17—Gulf Coast Association of Geological Societies, First Annual Meeting, Roosevelt Hotel, New Orleans, Louisiana.

Nov. 15-17—Rocky Mountain Oil and Gas Association, Annual Meeting, Cosmopolitan Hotel, Denver, Colorado.

Nov. 19-20—Society of Exploration Geophysicists, Annual Mid-west Regional Meeting, Baker Hotel, Dallas, Texas.

Nov. 25-30—The American Society of Mechanical Engineers, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, New Jersey.

Nov. 26-Dec. 1—23rd Exposition of Chemical Industries, Grand Central Palace, New York, New York.

NOMADS TO MEET

New York, N. Y., Chapter, Sept. 11, Luncheon, Downtown Athletic Club; Sept. 18, Fall Golf Party, Knoll Golf Club, Boonton, N. J. Oct. 1 and 29, Regular Meeting, Louis Sherry's, Dec. 8, Christmas Dance and Dinner, Hotel Pierre, New York, N. Y. Secretary Fred J. Jobst, c/o Val A. Wittich, Jr., 30 Rockefeller Plaza, New York 20, New York.

Houston Chapter, Second Monday of the Month, Ye Olde College Inn, Houston, Texas. Secretary E. F. Baldwin, Hughes Tool Company, Box 2539, Houston, Texas, WO-3101.

Los Angeles Chapter, Second Wednesday of the Month, Jonathan Club, Los Angeles, Calif. Secretary W. A. Wilson.

Tulsa Chapter, Third Friday, "After Five" Room, Hotel Tulsa. Secretary R. E. Kirberger, Unit Rig Manufacturing Company, Tulsa, Oklahoma.

Dallas Chapter, Dallas, Texas, First Monday of the Month. Except October 29, Dallas (Nov. Meeting). Secretary Gene Shiels, 205 Irwin-Keasler Building, Dallas, Texas, Riverside 4042.

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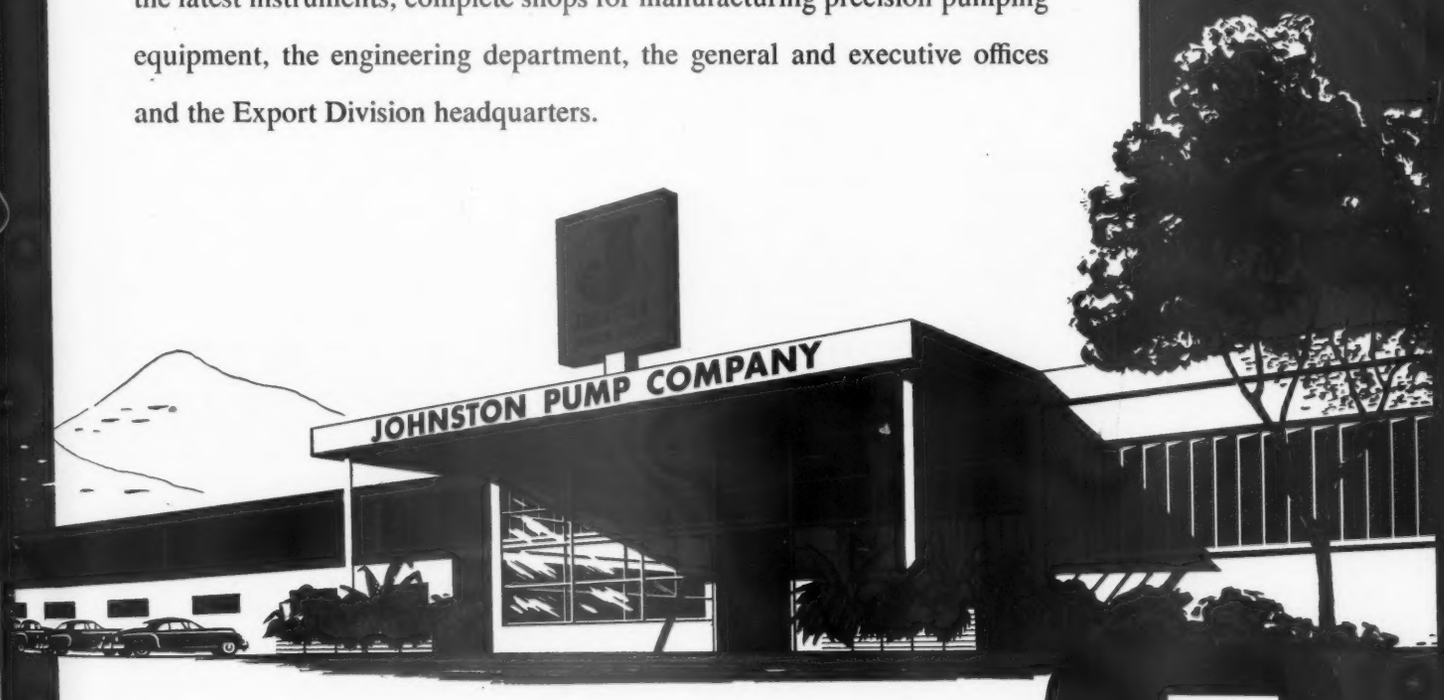
Plant facilities include a pump testing laboratory equipped with the latest instruments, complete shops for manufacturing precision pumping equipment, the engineering department, the general and executive offices and the Export Division headquarters.



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LETTERS *to the* EDITORS

DISCUSSION ON COLLAR TYPE ELEVATOR IN DEEP CASING

To W. A. Wilson:

I have just now read over your article on Page B-76 of *The Petroleum Engineer* for May, 1951, entitled: "Collar Type Elevator in Deep Casing Operations." This was quite interesting to me and I would like to offer a few comments thereon.

To the best of my knowledge, no operator nor pipe manufacturer ever suspected for a moment that collar type elevators would, in themselves, reduce the joint strength of casing. What we worried about, and what we still worry about, is the possibility of the coupling bearing face not being seated properly on the elevator shoulder so that there would be a tilting action on the coupling which could "flip" it off the pipe at much lower than the normal load. This possibility need not be a reflection on the collar type elevator.

In something over 25 years experience in studying tubular failures I have examined, or had described to me, many cases where collar type elevators caused couplings to jump off the pipe. Sometimes we suspected that a foreign object had kept the coupling from seating squarely. Sometimes we noted that a coupling with a damaged or too narrow a bearing face had allowed one side to wedge its way down lower than the opposite side. More often, however, we found that the elevators simply had been allowed to wear beyond their safe life span. In every case we felt very certain that the failure was a direct result of non-uniform loading.

You will admit, I'm sure, that none of the above mishaps could affect slip type elevators. Either they will grip properly or they will not grip at all and the chance of ever dropping a string is negligible. Even a sudden failure of an elevator bale, which would be almost certain to flip off a coupling, using the collar type elevator, would still not drop the string if a slip elevator were used.

Hence the very positive recommendation of all pipe manufacturers and practically all operators that slip type elevators be used for long strings of casing. For tubing, on account of the upset and because of the relatively large bearing face of the couplings, we are quite satisfied with collar type elevators.

You mentioned, in your article, the rather remote possibility that a coupling might not be properly made up. I agree, but have you considered the slowly developing trend of ordering couplings made up only handling tight, so that both ends will be made up simultaneously? This is for more positive sealing against leakage. In such cases collar type elevators would, of course, be out of the question.

You certainly went to considerable effort to prove your point, and I agree that you proved it quite satisfactorily. It is unfortunate that someone had not mentioned to you what I believe to be the true reason for recommending slip type elevators for long strings of casing.

I note one small error in your Table 2, where you quote API joint strengths as *averages*. These, you will find in the API Specifications, are minima. Dividing 254,000 (or 345,000) by .8 will give you *average* figures.

H. G. Texter

Chief Field Engineer
Spang Chalfant, Division of
The National Supply Company
Tulsa, Oklahoma.

Reply

To H. G. Texter:

I wish to extend my sincere thanks to you for your letter of June 13 commenting on my article on Casing Elevators which ran in *The Petroleum Engineer* magazine. This will be an attempt to answer the points put forth in your letter, some of which are more familiar to you because of your past experience with oil field tubular goods.

As was pointed out in the article, a large West Coast oil company raised the question as to why it was that the company had a rule that slip type elevators must be used in running casing below a given depth. In attempting to justify the existence of such a rule, several suggestions were made, among which was the possibility that a collared joint supported in an elevator was not as strong as the same joint threaded to two lengths of casing. This same opinion was expressed to me in person a year or so ago by an engineer for a French drilling company.

If, when the local oil company engineers approached the Los Angeles representatives of a large pipe manufacturer, they had been assured that in supporting a string of casing in a collar type elevator the strength of the coupling would not be reduced, there would have been no reason for conducting the test. Our tests showed that there is no appreciable reduction in the threaded joint while being supported in a collar type elevator, but there is at least one local pipe company representative here in Los Angeles who is of the opinion that if these tests could have been carried on in the range of heavier casing weights, that we might find some reduction of joint strength. This is only speculative thinking because there are no collar type elevators available in these sizes of sufficient capacity to make such a test.

We have no doubt that a condition of eccentric loading between the coupling and the elevator would tend to weaken the threaded connection supported on an elevator, but we wish to point out that in our tests no special measures were taken to assure proper contact between the elevator and the collar. The elevator and the elevator links were taken from stock so as to simulate field conditions as nearly as possible. The length of the links were within the manufacturing tolerances as they had been accepted by our inspection department.

In this regard, though, I should like to point out that it is far less expensive for an operator to keep a collar type elevator in good condition than a slip-type elevator and when a collar type elevator is maintained in reasonably good shape, it is reasonable to expect that the effects of non-uniform loading of the casing coupling can be eliminated.

What would happen to either a slip type or collar type elevator and the casing in it in the event of the failure of an elevator link is hard to say. It is a fairly safe conclusion, though, that the remaining link would probably not support the whole load anyway. This probability takes us back to the consideration of keeping equipment in proper repair. Elevator links should be given the same consideration as elevators or other pieces of hoisting equipment. If they receive this consideration, because of their simple construction, failures can be surely eliminated.

If an elevator link failed while supporting a heavy string of casing in a slip elevator, I would not be one to say that the resulting eccentric load on the length of casing in the elevator would not cause it to strip out of the coupling just below the elevator.

I have talked to pipe representatives and oil companies here on the Coast and we have not heard of any casing

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being specified with couplings made up handling tight. This practice as far as our knowledge is concerned, seems to be limited to tubing. In this regard, I was interested to learn that the joint strength of upset tubing with couplings made up handling tight is still greater than the strength of the body of the tubing. Admittedly, in casing, the effect of proper thread make-up has a greater effect on joint strength.

Many of us are familiar with the discussions that have gone on for several years about the effect of notch-sensitivity on N-80 grade tubular goods. Many failures in this grade of casing or tubing have been attributed to the inherent notch-sensitivity of this high-strength material. We know, too, that most pipe manufacturers are working on new steels for tubular goods that will have even higher strength and greater hardness than those in use today. It is reasonable to expect that the effects of notch-sensitivity will be even more pronounced in these new steels. It is therefore important, we believe, to consider the fact that a collar type casing elevator does not mark the casing in any way. It is also reasonable to believe that the joint strength of a coupling supported in a collar type elevator would be less subject to the effect of eccentric loading if manufactured from these new higher strength steels. With the increased strength of steel and the accompanying increased hardness we can expect more and more difficulty in making slip type elevators that will grip the pipe effectively over a long period of usage without requiring replacement or re-sharpening of the gripping elements.

Again I wish to extend my appreciation to you for the interest that you have displayed in commenting on my article. Many of the points of discussion are speculative, but at least they are thought-provoking. It is to be hoped that discussion such as this will work to the ultimate benefit of the industry as a whole. If that can be accomplished in even a small way, we will feel that our efforts have not been expended for naught.

W. A. Wilson

Web Wilson Oil Tools, Inc.
Los Angeles 2, California.

Technical Forum

To The Petroleum Engineer:

When the privilege of being a member of the Technical Forum of *The Petroleum Engineer* (Refining and Gas Processing) was extended to me, I accepted because it gave me the opportunity to help solve some of the cleaning problems of the petroleum industry. I feel that *The Petroleum Engineer* is rendering a worthwhile service to the industry by interchanging technical information, and I am happy to expend extra effort in making my contribution to the Forum.

But this should not be construed as an individual effort, because the company that I represent lends every encouragement to its members in assisting, wherever possible, in the work of solving technical problems. We all try to be as thorough and as complete as we can in advising men in all industries on solving their cleaning problems.

This brings to mind one comment I feel should be made about the completeness of the good work the Technical Forum is doing. Could it be called to the readers' attention that there may not always be space enough for the Forum to answer all the questions fully? Naturally, Forum members do the best they can in the space allotted. So it is suggested that if a questioner feels he has not received a full and helpful published answer from the Forum, he should directly contact the particular Forum member to whom his questions are addressed.

Vincent E. Bowes

Manager
Petroleum Service Division
Oakite Products, Inc.

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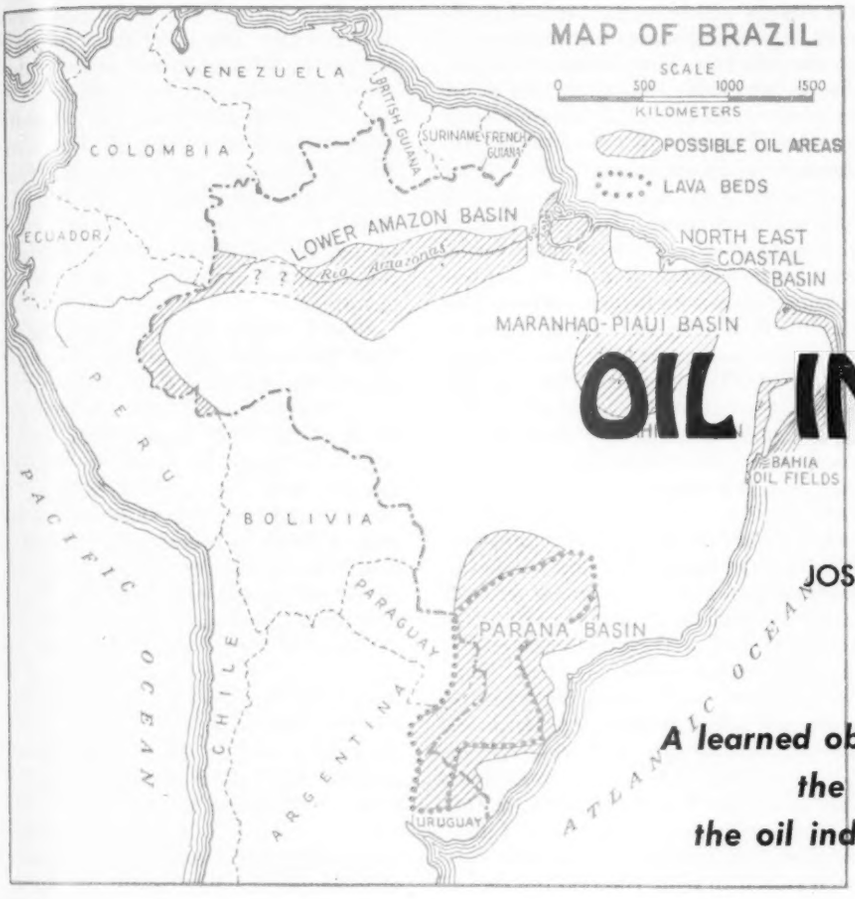


OIL IN BRAZIL†

JOSEPH E. POGUE*

A learned observer of the oil industry adds the third essay to his series about the oil industry in neighboring countries

PART 1

MANY years of study and observation of the petroleum industry, both in the United States and other countries, prompt me to believe that the development of oil is determined by four circumstances that must exist in conjunction for optimum results. These factors are: Suitable geological conditions; access to markets at competitive costs; political conditions favoring individual enterprise, and incentives capable of setting in motion and sustaining a variety of efforts.

If nature has not favored a region with hydrocarbon resources, oil production is obviously impossible. Or, if oil potentialities exist but their realization entails higher costs than those prevailing elsewhere, progress can be made only slowly by the best procedures and scarcely at all by inferior methods.

Since oil developments require vast amounts of capital and a wide range of intricate techniques, a combination of resources and markets with acceptable costs is still inadequate without a political setting that will encourage risk-taking by suitable organizations. And even with all these conditions favorable, a prolonged expenditure of time, energy, and capital must be anticipated before results of outstanding importance can be assured.

To run the gamut of the many hazards that lie between hope and realization, a powerful effort must be put forth. And the endeavor must be continued in the face of many disappointments and discouragements. To make certain that the effort will be of adequate scope and duration there must be a driving force of the first order—a stimulus that can best be provided by the lure of a reward commensurate with the risks assumed. And if this urge to action is such as to bring forth a variety of undertakings, so that if one fails there will be others to carry on, then the vigor of the entire project will be assured by the dynamics of competition. Oil lends itself reluctantly to lesser persuasions.

Within the past three years it has been my privilege to study the petroleum industry in three foreign countries—Venezeula, Canada, and Brazil—each involving different stages of development and each surrounded by unlike economic and political conditions. The first two have been discussed in some detail elsewhere;[1] the third is the subject of this essay. These contrasting examples may prove illuminating as case histories for consideration by those interested in the significance of oil and the conditions that promote its availability.

Venezuela is a country of large oil resources the development of which has been entrusted to private enterprise. The result, in a few decades, has been the establishment of that nation as the second largest producer of crude oil in the world. As the local consumption of oil is relatively small, most of the production goes into world trade, ranking Venezuela as the foremost exporter of petroleum. Relations between the government and the oil companies have been satisfactory, and confidence in the future has carried developments to their present high levels. Up to the present there has been reliance upon the government's policy of maintaining the rights of the operators as granted by their concession contracts, the oil law, and its regulations.

†Reprinted from a booklet published by the Chase National Bank, of the City of New York.

*Petroleum consultant, Chase National Bank, of the City of New York.

[1] *Oil in Canada*, published by the Chase National Bank, Petroleum Department, February, 1949. *Oil in Venezuela*, published by the Chase National Bank, Petroleum Department, June, 1949.

Venezuela, however, has taken three steps that may have economic consequences of special importance to her customers. First, for several years Venezuela has held back the granting of new concessions, thus limiting oil discoveries to areas already conveyed for production. The long process of exploration that must precede discovery has been left inadequately covered, and a hiatus in supply may arise in view of the rapid expansion of oil requirements throughout the world. Second, through the establishment of the so-called "50-50" principle, the government has raised its participation in the financial results of oil activities to an equal sharing of the profits of each company, while at the same time labor regulations and inflationary trends have greatly increased operating expenses and construction costs. Thus a reciprocating action has been set in motion whereby the expenditure of the funds derived from the oil industry tends to raise the general price level, while the higher costs thereby created serve to reduce the social effectiveness of the proceeds and to retard the processes of capital formation. Production costs have been increased in the process so that world markets are having to meet an added economic burden. Third, Venezuela has imposed the requirement that part of the local production be refined within the country, thus causing high-cost refineries to be established and interposing an artificial element in the flow of oil in international trade. Coupled with a tendency of importing countries to require the oil consumed to be processed locally, this trend will eventually lead to a difficult economic impasse whereby the demand will be for crude oil while the supply will be in the form of products. All three policies are detrimental to the markets Venezuelan oil is desirous of serving, and from the point of view of a consuming country such as Brazil they can scarcely be regarded as advantageous.

Canada is in the early stages of a vast oil development, which is attracting widespread attention in a world where many areas of promise are receiving far less exploratory effort. The Prairie Provinces in Western Canada include a sedimentary basin covering over 500,000 sq miles, which is the scene of a major campaign of exploration and drilling by scores of oil companies and individuals. Although significant production was found as early as 1914 in Turner Valley in the foothills of the Rocky Mountains in Alberta, the search for new oil fields initiated by this development proved fruitless until the discovery of the Leduc field 33 years later in the plains area 190 miles to the northeast. This event led to accelerated exploratory activities which quickly spread over a vast area and rose to a crescendo of boom conditions. In the past four years, almost 1.5 billion bbl of oil have been proved in a series of discoveries, allowable production has been raised to over 150,000 bbl daily, a large pipe line to distant markets has been constructed, new refineries have been built and old ones enlarged, and there is every evidence to suggest that a great oil producing region has been opened. Oil developments as well as all other phases of the oil business are delegated entirely to private enterprise, competition between operators has been actively promoted, and incentives have not been destroyed by excessive taxation or impracticable operating terms. The petroleum laws under which the companies operate are not in all particulars as favorable as might be desired, but confidence in fair treatment has gone far to insure vigorous and expanding efforts.[2] Canada is fortunate in having the four conditions described earlier as best suited for optimum results. In consequence the oil world looks to Canada for sustained expansion as a source of petroleum.

Brazil stands in sharp contrast to both Venezuela and Canada. It has not seen fit to entrust the development of its oil resources to private enterprise. As a result, with sedimentary basins nearly as large as those of Western Canada and Venezuela combined, it has created through state enterprise only a small production of oil and is dependent upon imports for practically all of its oil requirements. True, despite its great size, Brazil as a hunting ground for oil fields does not appear to be of the first rank and is therefore not outstandingly attractive, but this merely means that extraordinary effort will be required to achieve results. And should state enterprise prove inadequate for the specialized nature of the job, as experience elsewhere suggests, Brazil has little chance of becoming self-sufficient in oil so long as present conditions prevail. Even if its policy changes so as to attract the diversified and integrated efforts which alone can be counted upon to create the prospects of optimum results, more time will be required to overtake demand than would have been necessary before the advent of the recent era of accelerated oil requirements. As time goes on, the penalty for being late increases.

Izvestia Reports on USSR Oil

By the end of 1949, the regions of Krasnodar, Grozny, and Western Ukraine, Russia had been restored to their postwar level of production, Nikolai Baibakov, minister of the oil industry in Soviet Russia stated in a recent article in *Izvestia*. Outlining the postwar achievement in Russia's oil industry, Baibakov stated that in 1950, as a result of intensive prospecting and drilling, production exceeded the 1949 level by 22 per cent. Surveys have also been made of the entire central part of Russia, and in the previously unexplored areas of the Black Sea coast, the Donets Basin, and in other areas.

On the technical side of the oil industry, the minister of oil stated that oil is now being pumped from a depth of 2000 meters (6562 ft) and turbine drilling is used much more extensively. The rate of increase of output has been tripled in the past 5 years as compared with 1936 to 1940, the report claimed. Refineries have increased their output of light petroleum products, and in the eastern regions of the USSR, tractor kerosine, diesel, and motor fuels are now processed from sulfurous crude. The eastern regions of USSR now provide 44 per cent of the country's oil, against 12.3 per cent during the last Five Year Plan.

Development is taking place of new oil deposits in the Bashkirian and Tatar Autonomous Republics, and in Kuibyshev, Baibokov reported.

PART 2

Brazilian Oil Industry

The Brazilian oil industry is unintegrated in pattern and structurally composed of a mixture of state enterprise and private operations, with the latter subject to a complex system of state regulations and price controls. As such, it constitutes an interesting illustration of the economic consequences of nationalistic trends, which are observable in many parts of the world and have considerable popular appeal.

Production is carried on by a governmental body called the National Petroleum Council,[3] which operates the oil fields of the country as a monopoly and produced about one per

[2]The importance of confidence as a factor in all business dealings can scarcely be overemphasized. See Harry Scherman *The Promises Men Live By*, New York, 1938, for an illuminating treatment of this theme. Confidence is the basis of credit which is readily transmuted into capital.

[3]Conselho Nacional do Petroleo.

cent of the country's oil requirements in 1950. Refining is conducted in four very small refineries, one owned by the government and three operated by private Brazilian interests. Their aggregate output represents about four per cent of the country's oil requirements, but a large refinery is under construction by the government and others of a private status are in the blueprint stage, so that there is a strong trend toward local refining. Marketing is entirely in the hands of private enterprise. Five oil companies operating as foreign subsidiaries of international oil organizations have supplied most of the capital for the development and functioning of a system of deep-sea terminals, interior depots, tankcars, filling stations, curb pumps, and other facilities utilized in the distribution of petroleum products to the consumers of Brazil. As is the case in the United States, many local merchants have availed themselves of the opportunity of performing the retail function through existing establishments and special stations financed in many cases by the suppliers. The marketing system has developed as the result of the desires of the oil companies to find outlets for their products and the needs of the Brazilian consumers to acquire supplies for their use.

Brazilian Oil Legislation

The characteristics of an oil industry are to a considerable degree determined by the applicable laws and regulations under which it must operate. Therefore it is desirable to set forth a brief summary and interpretation of the legal background affecting oil operations in Brazil.

In its 1937 Constitution, Brazil adopted for the first time a provision that exploration and producing rights could be held only by Brazilian citizens or companies, all the shareholders of which should be Brazilians, thus effectively prohibiting any foreign participation. The 1940 Mining Code and the 1941 Oil Law confirmed this prohibition. The 1946 Constitution provided, however, that oil exploration and development rights could be held by Brazilians or by companies organized in Brazil. There was no requirement as to the nationality of shareholders of such companies organized in Brazil, and it is clear from the debates in the constitutional convention that this language was intended to open the door to foreign capital. Notwithstanding this intent, the 1940 Mining Code and the 1941 oil law are still on the books and the government has not yet enacted new legislation implementing the 1946 Constitution.

As to the legal status of refining and other branches of the oil business, these activities are regulated under Decree Law 395. This law, dated April 29, 1938, declared generally that all participation in any branch of the oil industry is a matter of national interest and subject to government control. It established the National Petroleum Council to exercise control and granted this agency broad authority to issue import licenses, regulate prices, engage directly in exploration, production, refining, and so on. The Decree also declared the refining of petroleum to be "nationalized," with the ownership, operation, and management of refineries in Brazil restricted to Brazilian citizens or the government.

As, in the first place, Decree Law 395 did not rest on constitutional authority, its validity was not apparently affected by the passage of the 1946 Constitution. Although some Brazilian legal opinion is said to hold that Decree Law 395 is unconstitutional, the government is not likely to sanction anything contrary to its terms so long as it is on the books.

Obviously Congressional action is needed to bring the laws up to date and in harmony with the Constitution. For the active development of the Brazilian petroleum industry, the best solution would be the passage of a sound and modern general petroleum law that would open the door to free competition by both Brazilian and foreign companies on terms attractive both to the government and to the contractors. At least two attempts have been made to draw up such a law, but no action has been taken.

The Resource

The existence of a substantial petroleum resource in Brazil is purely a matter of geologic inference. A few small oil fields, with aggregate reserves of perhaps 25 to 50,000,000 bbl have been developed by the National Petroleum Council in the relatively small Bahia Basin, but beyond this attainment geological surveys have provided merely the rough configuration and characteristics of a half-dozen immense sedimentary basins of a type that might yield oil. These areas, shown in Fig. 1, comprise more than 750,000 sq miles and will require extensive exploration to reveal their content. For the most part, the sediments in these basins are apparently too thinly developed to

FIG. 1. Sketch map of Brazil showing the outlines of the sedimentary basins in which oil may be found. These basins in the aggregate cover over 750,000 square miles. Oil is now being produced from a part of the Bahia Basin.

TABLE 1. Production of crude oil and demand for petroleum products in Brazil by years, 1940-1950.

Year	Barrels per day: Production of crude oil	Demand for petroleum products	Production in per cent of demand
1940.....	6	28,900	0.02
1941.....	9	30,100	0.03
1942.....	90	22,600	0.40
1943.....	132	17,300	0.76
1944.....	157	20,700	0.76
1945.....	217	23,300	0.93
1946.....	183	44,600	0.41
1947.....	264	56,300	0.47
1948.....	392	63,700	0.62
1949.....	299	75,500	0.40
1950.....	928	91,500	1.01

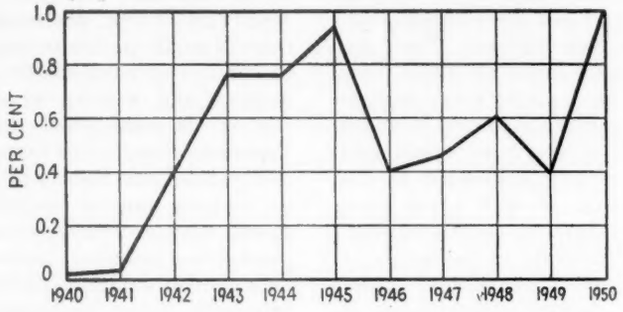


FIG. 2. Trend of oil production in Brazil expressed in percentage of oil consumption. Note that production in 1950 was one per cent of consumption.

constitute what is generally regarded as first-class prospects. Incentives, accordingly, should be especially powerful and clearly assured to offset the augmented risks of wildcatting against long odds.

Oil is actually being produced only in the Bahia Basin, but the fields developed to date have been small, averaging about 3,000,000 bbl of reserves each. This basin is the only one of its kind in Brazil. While the other sedimentary basins in the country are saucer shaped, the Bahia Basin is a graben, or down-faulted block, similar to the Gulf of Suez. It is about 25 miles in width and 124 miles in length, has a north-south trend, and ranges in thickness from 4000 to 11,000 ft in its southern, deepest portion. Its indicated area is less than 2 per cent of that of each of the several larger basins.

Up to January 1, 1950, the proved reserves in the Bahia Basin were estimated at 25,000,000 bbl. Since then, several additional discoveries have been reported by the National Petroleum Council, which is the sole operator. If the optimistic reports are correct, the reserves may now be 50,000,000 bbl or more. Production in the Bahia Basin for the 11 years ending with 1950 totalled 977,200 bbl. In 1950, the output averaged 928 bbl per day about one per cent of the country's annual requirements. See Table 1 and Fig. 2. In that year, 29 oil wells, 2 gas wells, and 5 dry holes were completed.

Refining

At present Brazil has about 4000 bbl per day of refinery capacity. The existing plants are four in number, as follows: 1. *Mataripe refinery*, situated at Bahia, government owned and operated by the National Petroleum Council, capacity 2500 bbl per day. This plant was put on stream in October, 1950, and a contract has been signed to enlarge it to a capacity of 5000 bbl daily. 2 *Ipiranga refinery*, situated at Rio Grande do Sul, owned by private Brazilian interests, capacity 1000 bbl per day. An increase of 3000 bbl per day is said to be projected. 3. *Matarazzo refinery*, at Sao Paulo, owned by private Brazilian interests, capacity 200 bbl per day. 4. *Uruguaiana refinery*, at Rio Grande do Sul, believed to be privately owned, capacity 300 bbl per day.

Recently the Brazilian government has commenced the construction of a refinery at Cubatao between Santos and Sao Paulo, with an expected capacity of 45,000 bbl per day. If actively pushed, this plant can be completed by 1954-55. In addition, private interests are said to have projected the construction of a 10,000 bbl per day plant at Rio de Janeiro, a 20,000 bbl plant at Sao Paulo, and a 30,000 bbl plant at Niteroi across the Bay from Rio. None of the latter three has apparently reached the stage of assured completion. The aggregate capacity of these four embryonic plants is slightly greater than the 1950 consumption of oil in the country.

A strong trend toward the development of local refining in Brazil is therefore apparently under way although the details and the time gradients are still in a state of flux. The pattern is taking the shape of a mixture of governmental and private enterprises, with the relationships between the two still obscure and indeterminate. A similar admixture of public and private refining operations has evolved in Argentina to the south, where state activities have assumed a dominant position in all departments of the oil industry and the role of private enterprise has dwindled.

The proposed construction of refineries in advance of indigenous production is doubtless intended to save dollar exchange. The projects as outlined, however, represent an unnatural development from the point of view of furthering the pattern of integration so desirable to promote a continuity of supply from foreign sources for the duration of such a need and so necessary to augment the incentives conducive to a vigorous competitive search for oil at such time as this objective may be deemed advantageous. Therefore the employment of special expedients to gain quickly a refining capacity equal to the consumption requirements may result in the duplication of facilities available elsewhere, with resultant increase in operating costs, and prove deterimental in the long run to attaining a corresponding balance in crude oil production. In addition, the mixed pattern of governmental and private operations, as now in prospect, raises difficult problems of adjustment for the future.

Marine Transportation

The Brazilian Government, with the objectives of reducing the drain on hard currency exchange and eliminating dependence upon foreign flag vessels, has ordered a number of tankers. Eleven ocean-going tankers are being constructed and are scheduled for completion by July 1952. Together with two existing Brazilian tankers, the Brazilian tanker fleet theoretically could handle the equivalent of 35 per cent of the 1952 import requirements. Unless operations are conducted on a basis of commercial practices, however, the expected economies may not materialize. The ocean-going tankers are doubtless intended to be used principally to transport crude for the large government refinery but the present importers may be called upon to use this tonnage for several years. Unless time charters are provided for, it is inevitable that confusion will result in trying to coordinate outside tonnage with national ships.

The Brazilian Government has also placed orders for nine coastwise tankers for transshipment of products from deep water terminals to coastal bulk plants. Here, Brazilian law prohibits foreigners from owning the majority of any coastwise shipping interest. Undoubtedly, did this restriction

TABLE 2. Demand for petroleum products in Brazil classified by major uses, by years, 1948-1950.

(Expressed in thousands of barrels per day and per cent of total demand)

Uses	1948		1949		1950	
	Volume	Per cent	Volume	Per cent	Volume	Per cent
Autos, incl. taxis	10.2	16.0	11.7	15.5	13.2	14.4
Trucks	14.6	22.9	17.4	23.0	19.0	20.8
Busses	1.8	2.8	2.3	3.0	2.6	2.8
Railroads	1.6	2.5	2.3	3.0	2.6	2.8
Aviation	2.8	4.4	3.1	4.1	4.1	4.5
Miscellaneous transport	1.9	3.0	2.2	3.1	2.6	2.9
Total transport	32.9	51.6	39.0	51.7	44.1	48.2
Dwelling units	3.6	5.7	4.5	6.0	4.8	5.2
Ind. use and coml. heat	21.0	33.0	26.2	34.7	35.1	38.4
Agriculture	0.1	0.2	0.1	0.1	0.1	0.1
Oil industry use	0.1	0.2	0.3	0.4	0.3	0.3
International bunkers	2.1	3.3	1.5	2.0	1.1	1.2
Miscellaneous uses	3.9	6.0	3.9	5.1	6.0	6.6
Total domestic demand	63.7	100.0	75.5	100.0	91.5	100.0

not exist, the industry would be obliged to meet the requirements without involving the government in what may be an expensive and rather complicated operation.

Distribution

The distribution of petroleum products is handled by competitive enterprise. Most of the marketing business is conducted by Brazilian subsidiaries of four United States oil companies and one British oil company that are all integrated units operating in many parts of the world. These companies import most of the necessary oil in the form of products, which are shipped from refineries in the Netherlands West Indies and Venezuela and derived from crude oil produced in Venezuela. Once the oil reaches Brazil, its distribution is costly because of inflated capital and operating expenses, high-cost terminalling requirements, complicated regulations, and the inefficient status of available transportation facilities.

The demand for oil products in Brazil averaged 91,500 bbl per day in 1950. This figure ranks Brazil as 13th among the world's oil consumers and 6th in the Western Hemisphere. Expressed in per capita terms, Brazil's 1950 oil consumption was 28 gal., about a third of the average for Latin America and a half of that for Europe. Brazil's oil consumption, however, is notable not so much for its absolute magnitude as for its recent rapid growth. For example, the rate of increase was 19 per cent in 1949 and 21 per cent in 1950. See Table 1 and Fig. 3. A summary of demand by major uses for the past three years is shown in Table 2 and Fig. 4.

Up to 1946, over three-quarters of the total energy consumed in Brazil was provided by wood. Forest reserves accessible to the industrial areas, however, have become seriously depleted, with the annual utilization about five times the rate of replacement. Wood has consequently become increasingly inaccessible and costly. Coal which for 20 years has supplied from 9 to 14 per cent of the total energy, is also generally uneconomical. Largely because of government regulations, two-thirds of the coal consumed is obtained from local production. The domestic coal is low in heat content, high in waste matter, and costlier than the imported variety. Water power, similarly, has failed to meet require-

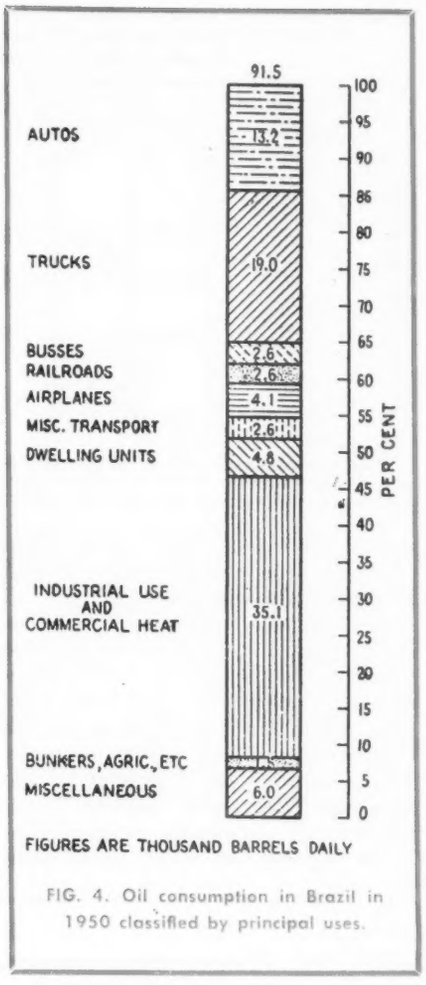


FIG. 4. Oil consumption in Brazil in 1950 classified by principal uses.

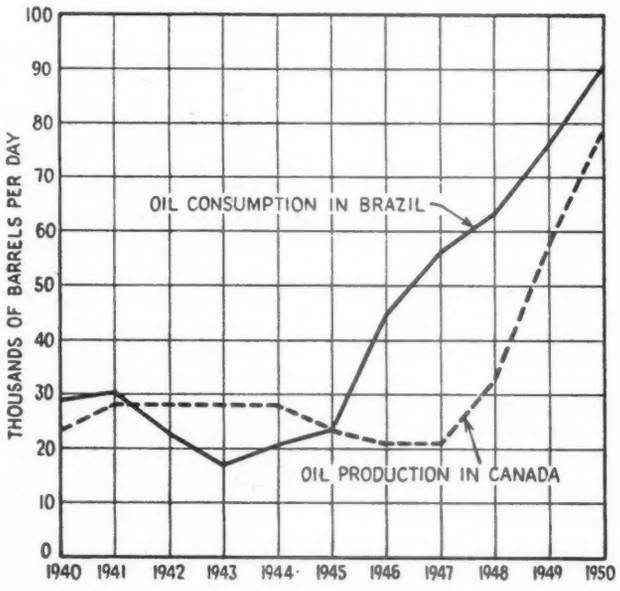


FIG. 3. Trend of oil consumption in Brazil by years, 1940-1950. Note the level demand for the first half of the period and the sharply rising trend since 1945. By a dotted line, the oil production of Canada is superimposed on the chart, illustrating the effect of a vigorous campaign of search in that country on the part of competitive enterprise and suggesting what might have happened in Brazil if similar procedures had been followed. Canadian production exceeded 100,000 barrels daily by June, 1951.

TABLE 3. Trend of Brazil's internationaltrade by years, 1935-1950, showing relative position of petroleum imports.

(In millions of U. S. dollars converted from cruzerios at prevailing buying rates)

	Exports					Imports				
Year	Coffee	Raw cotton	Cacao	Others	Total	Petroleum	Machinery	Wheat and flour	Others	Total
1935.....	179	54	14	93	340	27	40	40	203	330
1936.....	191	80	22	126	419	28	62	56	217	363
1937.....	187	82	20	151	440	34	89	62	281	466
1938.....	134	54	12	98	298	20	67	33	176	296
1939.....	134	70	14	119	337	23	63	22	192	300
1940.....	96	51	12	141	300	29	48	29	192	298
1941.....	122	61	19	205	407	31	60	30	212	333
1942.....	119	39	13	283	454	27	43	37	176	283
1943.....	170	25	21	313	529	33	52	48	242	375
1944.....	235	40	19	356	650	29	71	73	318	491
1945.....	258	64	14	403	739	32	88	89	320	529
1946.....	390	178	39	498	1105	48	168	57	517	790
1947.....	422	167	57	506	1152	78	284	133	722	1217
1948.....	491	184	58	447	1180	114	255	133	619	1121
1949.....	632	109	52	303	1096	112	143	124	724	1103
1950*.....	865	105	79	306	1355	117	119	98	751	1085

* 11 months.

These data were compiled from official statistics of Brazilian Ministerio do Fazenda and converted into dollars by Latin-American Division of the Foreign Department of the Chase National Bank.

ments, mainly because power plant capacity in industrial areas cannot keep pace with demand.

With these alternate sources of energy insufficient or uneconomic, the trend to oil is inevitable. And in addition, oil consumption has been bolstered by a steady population growth of about one million persons annually, by the rapid industrialization of the Brazilian "Heartland," and by growing imports of machinery and automotive equipment. Since 1945, when the petroleum market began its great expansion, oil's share of total energy has risen sharply. The trend toward oil will undoubtedly continue unless limited by exchange conditions.

The Pivotal Role of Oil in Brazil's Economy

Brazil is a country of rich natural resources, probably more amply endowed in this respect than any other nation in Latin America. It is now engaged in rapid industrialization. This process is stimulated by the inflationary trends throughout the world. These external conditions have served to expand the value of Brazil's exports and to support a rising volume of imports, thus creating a prosperity that is conspicuous in cities such as Sao Paulo but is not widely diffused geographically nor well grounded in mining, agriculture, and transportation. These fundamental activities are handicapped by the lack of good coal, and by a special restrictive attitude toward capital. The attitude toward capital is a product of institutional barriers inherent in the social structure and landholding system prevalent throughout Latin America, as a result of which the accumulated wealth is largely held in real estate and other unproductive forms, while commercial undertakings, speculative ventures, and money lending are preferred to long-term investments.[5] Domestic capital, therefore, is not adequately available for efforts the returns on which are long deferred and foreign capital is not suitably encouraged to play this role. Accordingly there is a great shortage of capital in Brazil as evidenced by high rates of interest prevailing; and the developed sources of energy are likewise far short of requirements as indicated by the rapid growth in the consumption of imported oil. The one handicaps the development of Brazil's oil resources; the other points increasingly to such a need.

So far oil has been provided by purchase out of the proceeds of the exports of such commodities as coffee, raw cotton, and cacao, which are produced by individual effort. As shown in Table 3 and Fig. 5. the exchange derived from the export trade has been sufficient to meet the oil requirements, but this has been facilitated by the high prices obtained for the commodities exported and the relatively low price levels that have prevailed for the imported products of petroleum. A continued expansion of oil consumption, an ultimate rise in world oil prices, and an arrested trend in the market prices of coffee and other exported commodities would bring about a lessened availability of exchange relative to the augmented requirements for oil imports that might retard the continued industrial growth of Brazil. A more constructive attitude toward foreign capital and petroleum legislation designed to attract the best efforts of the competitive oil industry would go far in minimizing this risk.

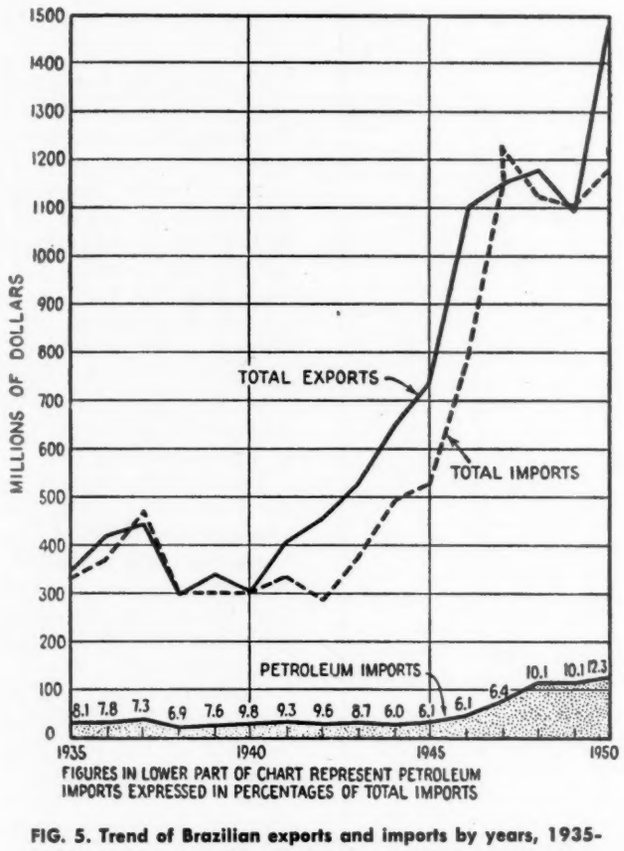


FIG. 5. Trend of Brazilian exports and imports by years, 1935-1950, showing the relative position of petroleum imports. Note that petroleum imports have risen sharply during the past few years.

[5]For a detailed discussion of these matters, see: Henry J. Aubrey, *The Role of the State in Economic Development*, American Economic Review, Vol. XLI, May, 1951, pp. 266-279; and Sanford A. Mosk, *Latin America versus the United States*, American Economic Review, Vol. XLI, May, 1951, pp. 367-383. * * *

Parts 3 and 4 will be published soon.

Observations of a "WOC"†

What helps and what hurts the government-industry relationship? Here a man from industry who went into federal service "without compensation" gives his views

A. P. FRAME

We "WOCs" do occupy a unique position in our economic structure. We are government employees with all the responsibilities and authorities that such government position imposes upon us, and yet our training and experience has been with industry, and we hope and expect to return to our industry positions at the earliest possible moment. We are "hybrid creatures" subject to all the difficulties and problems characteristic of hybrids, but by the same token, we are in a position to see and to evaluate the strong points and the weak points of both government and industry. The term itself means "without compensation" and is similar to the dollar-a-year man of World War II.

The whole subject of industry-government relationship is sometimes treated as though it were a twentieth century invention. This, of course, isn't true, since any government, no matter how primitive, must have had relations with industry in its domain, no matter how crude the industries. The relations may have been good or bad depending on the point of view, but relations of some kind there must have been.

In the case of the petroleum industry, there has been a long continued and presently highly developed relationship with the government. Early in the development of this industry, the relationship took the form almost solely of police action on the part of government culminating perhaps in the breakup of the original Standard Oil Company. Starting in the NRA days, the relationships between the government and the petroleum industry began to change from this concept of policing and suspicion to a more co-operative relationship.

During World War II days, both government and industry had borne home to them the inescapable fact that an adequate supply of petroleum is absolutely essential to national security in time of war as well as to national prosperity in time of peace. Both industry leaders and government leaders were awakened to the fact that only by joint efforts could the activities of the industry be guided to the end of securing ample supplies of petroleum products where and when needed.

At no time since the institution of the Office of the Petroleum Coordinator, prior to the entrance of this country into World War II, has there ever been a period in which a substantial number of petroleum industry people have not been actively working with some branch of the government in co-operative work. As you will remember when the Petroleum Administration for War was disbanded, there followed the creation of the Oil and Gas Division in the Department of the Interior. The Petroleum Industry War Council of World War II days was transformed into the National Petroleum Council. A Military Petroleum Advisory Board was formed of industry people who spent many hours in preparing and analyzing data so that our military establishment could know the feasibility of petroleum supplies under many different strategic assumptions.

With the outbreak of hostilities in Korea and the undertaking of a greatly expanded defense mobilization program, it was but natural that the petroleum industry should offer increased aid to the government and that the government should request substantial assistance from the industry in planning and carrying out this program. As a result, the Petroleum Administration for Defense was formed. It was staffed to a large extent by men who not only had served the government in PAW but in many cases by men who had been active in the National Petroleum Council or the Military Petroleum Advisory Board after PAW was disbanded.

That is the situation that exists today and that is why I can say that the relations between the petroleum industry and government are good. I do not mean to imply by any manner of means that these relations are perfect. Far from it. But I do believe that the petroleum industry is outstanding among all industries in having developed its relation with government to the high plane on which it rests today.

The fact of this good relationship is attested to by statements that have been made publicly many times by outstanding industry and government leaders. I have heard Secretary Chapman make this statement several times. I have heard the same thing from Congressional leaders, from officials in other government agencies, from the heads of oil companies, from various trade associations in the petroleum industry and from the man on the street.

As to the question as to why these relationships are good, the answer is perhaps not so readily apparent. I think perhaps from my observations that the reason the relationships are as good as they are, is because of the caliber and integrity of the men in industry and their counterparts in government who have brought this relationship to such a high level. I think the high character of the leaders in the petroleum industry was best exemplified by a meeting I attended in Los Angeles during the API meeting there last fall.

This was a meeting held in a large auditorium and presided over by Howard Marshall as vice president in crarge of the Marketing Division of the API. Secretary Chapman was scheduled to make a speech. It was a large auditorium seating many hundreds of people. It was held in the morning when, I am sure, many of the conventioneers didn't much feel like attending a meeting, but the auditorium was full to capacity.

Among the speakers who preceded the Secretary was Barney Majewski of Deep Rock, who I am sure most

†Taken from remarks of A. P. Frame, Assistant Deputy Administrator, Domestic Petroleum Operations, Petroleum Administration for Defense, before Kentucky Oil and Gas Association, Ashland, Kentucky, June 22, 1951.

of you know well. Barney made a speech, the first part of which had to do with marketing problems and activities, and then Barney swung into a purely patriotic speech. In it, he reiterated things which we as individuals know, but seldom talk about. He talked about the value of freedom, the advantages of being an American and the obligations that such a privilege carried with it. It wasn't too long a speech, but it was a good one, and in that entire auditorium I don't believe there was a single cough or movement. When Barney was finished, there was a burst of applause that attested to the seriousness with which that entire group had received the words he had to say.

To the cynical ones, that speech might have been termed "corny," but actually that speech and the way it was accepted proved to anyone that the petroleum industry is staffed by men who are deeply conscious of their social obligations as citizens of this country, and I believe it is this sense of social obligation which puts the petroleum industry in the forefront of co-operative industry-government activities. The petroleum industry realizes its responsibilities and knows that these responsibilities go beyond the matter of dollars and cents, and go rather to maintaining the strength and well-being of our country.

I could go on almost indefinitely giving specific examples of where the petroleum industry has demonstrated its desire to serve, but then I am sure many of you could also do the same thing.

When it became evident that if this country were to continue as a stronghold of freedom against the aggression of militant communism, it would be necessary to embark upon a tremendous mobilization program and that this program would require among other things the organization or reorganization of the petroleum industry - government team, which had functioned so well during World War II, it was but natural that the government should call upon Howard Marshall and J. R. Parten to bear the brunt of organizing such a team. I had the advantage of seeing the almost heroic efforts these men put into that task.

With such men as these as leaders in the petroleum industry and with the able assistance of other leaders too numerous to mention, there is no question in my mind but what this type of leadership has made it possible for the petroleum industry to offer to government their half of an industry-government team.

However, it takes two to make a bargain, and fortunately, there are in government able men who could and did accept the idea of a partnership with industry. As part of my function in PAD, I come in contact with Secretary Chapman. I know that he is an able administrator, a most conscientious public servant, and a real man.

Many of our Government leaders today recognize that the petroleum industry is global in nature and that statesmanship of the highest order is essential in dealing with world oil problems if serious and costly dislocations are to be avoided.

On the other hand, as so many industry people now have experience and intimate personal knowledge of government problems and procedure, it is but natural for them as they return to their private capacities as business executives to display a high sense of social obligation and to act accordingly.

The fact that good industry-government relationships contribute to the safety and well-being of the country as a whole is so obvious that it scarcely needs to be discussed. Such relationship contributes mightily to national security and to national prosperity. In fact, without such a relationship, it would almost appear that the nation had lost its strongest weapon in its fight against aggression.

Weak Points in Relationship

Up to this point, I have been talking about the good points in our government - industry relationships, but now I would like to turn to the obverse of the coin, and from my vantage point as a "WOC," examine with you some of the weak points in these relations. Perhaps you as oil and gas men can help in strengthening some of these weak points. I am not implying, of course, that all such weak points are the responsibility solely of industry—quite the contrary.

Government, of course, is composed of individuals, just as is industry, but government, being as large and complex as it is, has all types of individuals in varying positions of authority. Human nature being what it is, we have all kinds of people in government. There are a large number of exceedingly capable, hard working, and conscientious people. Unfortunately, there are also a number of incompetents—which phenomena I have even observed in industry. What perhaps accentuates this situation in government activities is the fact that sometimes through the mechanism of a rather formalized promotional system, some of these incompetents rise to a position of relative importance where their incompetence is not only wasteful but actually harmful in administrative affairs.

Also, in Government, you have some individuals who are very aptly described as "empire builders." These individuals are usually egocentrics with the selfish urge to gather unto themselves ever increasing power and authority in order to build up their own prestige. Such individuals are neither pro-government, or pro-industry, but rather pro-themselves. The danger of such people to the common good is that if left to themselves, they would damage irreparably both government and industry in their lust for power.

Then, there is the third and possibly the most dangerous relatively small group of individuals in government whose real threat to the nation lies in their absolute sincerity. These are the "ivory tower" theorists who sincerely believe, in their ignorance, that there just must be something slightly disgraceful about being in business at all and that a business man must of necessity be slightly disreputable. They tend to view business men with the same patronizing attitude that the British aristocracy once adopted toward its "tradesmen." Their actual knowledge of business operations is so limited and their theories so highly developed that they are literally incapable of understanding the true state of affairs. Because of their sincerity and the rigidity of their ideas, they are usually hard workers, and because of their energy, they frequently rise to positions of responsibility in government circles. Actually, such men are frequently intellectually smart, and it is in this intellectual ability of theirs, that lies the greatest hope of curing or at least ameliorating this flaw in our industry-government relationships.

Then, I'm sure that there are in government some bitter and disillusioned men who are "agin" everything, including business, business men, and anything and everything pertaining to business and industry. Their bitterness may stem from a sense of personal frustration, or un-

27th Oil State

North Dakota recently became the 27th state to produce crude oil in commercial quantities. The first well came in at a rate of 350 bbl of high-gravity crude daily. An indication of how recent is North Dakota's emergence as oil territory can be seen in the fact that in 1942 little or no land in the state was under lease while today more than half of the state's 45,000,000 acres are under lease to oil companies. . . . *Courtesy of The Natural Gasser.*

Republic National Bank of Dallas

Statement of Condition, June 30, 1951

RESOURCES

Cash and Due from Banks	$131,305,764.74
U. S. Government Securities	70,703,265.43
State, Municipal and Other Securities	6,881,194.55
Stock in Federal Reserve Bank	1,095,000.00
Loans and Discounts	217,692,215.35
Real Estate — New Building and Equipment	3,199,711.01
Acceptances — Customers Account	742,683.13
TOTAL	$431,619,834.21

LIABILITIES

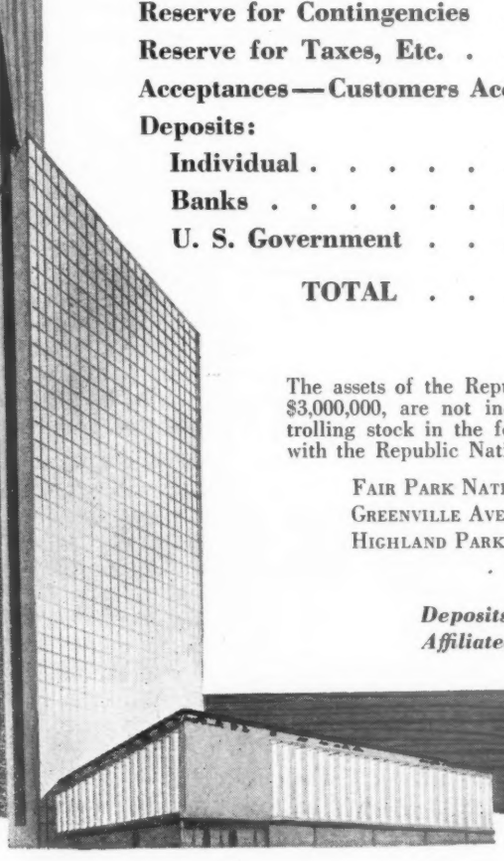
Capital	$ 18,000,000.00	
Surplus	18,500,000.00	
Undivided Profits	4,233,865.42	40,733,865.42
Reserve for Contingencies		3,534,195.42
Reserve for Taxes, Etc.		2,336,891.74
Acceptances — Customers Account		742,683.13
Deposits:		
Individual	253,902,333.17	
Banks	116,501,202.74	
U. S. Government	13,868,662.59	384,272,198.50
TOTAL		$431,619,834.21

★ ★ ★

The assets of the Republic National Company, including its capital stock of $3,000,000, are not included in above statement. The Company owns controlling stock in the following banks located in Greater Dallas, all affiliated with the Republic National Bank:

FAIR PARK NATIONAL BANK
GREENVILLE AVENUE STATE BANK
HIGHLAND PARK STATE BANK
LAKEWOOD STATE BANK
NATIONAL CITY BANK
OAK CLIFF BANK & TRUST CO.
OAK LAWN NATIONAL BANK

Deposits of the Republic National Bank and Affiliated Banks aggregate $478,053,408.85



MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

fortunate personal experience in or with business or from just plain stomach ulcers. I suspect that this type will always be with us and perhaps the counter-irritant effect of their approach to industry-government relationships may strengthen rather than weaken the end results of such relationships.

To summarize this "WOC's" evaluation of the weak spots in the government-half of the industry-government relationship picture, I have seen in government some individuals who are incompetent, or inordinately ambitious, or immature theorists or complete cynics but I have also seen a big majority of government employees who are hard working, conscientious, and able, who are often underpaid and who in many cases, forego the material advantages they could obtain through working for industry because they sincerely desire to serve the nation.

Now I would like to point out what appears to me to be certain weaknesses on the industry's side, which are adversely affecting the government-industry relationships, and here I will use examples which have actually occurred during the relatively short life of PAD. As a preface to this account, I would like to emphasize that the cases I am about to recount as being nonco-operative, represent only a very, very small part of the petroleum industry and that as a whole, the industry has co-operated beautifully with PAD and has been very understanding and helpful in all of the annoying controls and regulations it has been necessary to put into effect. Furthermore, as you will see, some of the cases to be recounted were caused not by responsible members of the oil and gas industries, but by persons apparently interested only in "making a fast buck," but whose actions nevertheless do reflect on the soundness and integrity of the petroleum industry, whether you like it or not.

PAD was successful in persuading DPA as to the necessity of continuing the manufacture of oil country tubular goods at the 1950 rate despite the over-all shortage of steel. As a result, NPA directed the mills to produce 450,000 tons of these materials for the third quarter of this year of which amount 351,000 tons were to be available for the domestic oil and gas industries. This quantity, plus second-hand, foreign and conversion pipe, with a reasonable reduction in inventory, was estimated to be adequate to permit third quarter drilling at the desired annual rate of 44,300 wells, which in itself was practically the 1950 total. PAD requested all operators to file applications for oil country tubular goods for the third quarter, in order to provide a basis for the distribution of the 351,000 tons available for the domestic operators.

The total of all requests as filed amounted to 1,200,000 tons or about three and a half times the steel available. Had it been possible to grant these requests, there would not have been rigs, manpower, or locations to bury anywhere near these quantities of tubular goods during the third quarter. In other words, a lot of operators simply kited their requests in the hope of securing for themselves a preferential position as regards some other operator. I hope that PAD was successful in its efforts to wring all the water out of such requests before any allocation was made.

There was one operator who filed a request for 100,000 tons of tubular goods for the third quarter, nearly one-third of the total available for all domestic operators, and then had the gall to say that it was impossible for them to state where it was going to be used until they were sure they could get it. P.S.—They didn't get it.

Among the nearly 4000 applications for allotments of tubular goods, there were some 600 from applicants who had no previous drilling history, according to their filings. Upon request by letter from PAD to furnish date of lease and plot of the lease upon which they proposed to drill, there was no reply at all from nearly 500 of the original applicants. Evidently, these characters had had only a desire to acquire some tubular goods — for reasons which you can readily guess.

Another type of case which doesn't help in maintaining a high level of industry - government relationship is where PAD is subjected to an intensive pressure campaign to force approval of some project desired by some company in the industry. Such pressure has taken the form of pressuring Senators and Congressmen, and State legislators, suggesting that these representatives in turn write to PAD, advocating the particular project. Now PAD has a healthy respect for the lawmakers and a cardinal rule of the agency is that every letter from a Senator or Representative must be answered promptly and in full. However, at the height of the pressure campaign of which I am speaking, a substantial portion of PAD's overworked staff was devoting its time to writing letters rather than attending to more constructive tasks.

There have also been a few cases, fortunately only a very few, where some individual dissatisfied with his allocation of oil country tubular goods has tried to get a preferential treatment by bringing political pressure to bear on PAD rather than by appealing his case to PAD for reconsideration.

This pressure has been attempted on the basis of political friendships, but you will be interested in knowing that as of the present time not one such attempt has been successful in the slightest degree in reversing or modifying a PAD allocation.

Certain oil companies, again only a very small minority, threatened that unless their own particular allocation of lead tetraethyl was increased by PAD, they would no longer continue to supply aviation gasoline to our armed forces, and this despite the fact that TEL was allocated in a uniform manner to all companies. Such a threat not only displays a lack of understanding of their social responsibilities on the part of the companies or individuals involved, but also has a definite weakening effect on the whole industry-government relationship structure.

Another and particularly malicious attack on the understanding between the petroleum industry and government has been made by certain individuals who without bothering to check the accuracy of their statements have either orally or in written form stated that some or all PAD people were displaying favoritism in the allocation of materials, inferring at least, that such favoritism was going to the companies from which the individuals had originally come. Such a statement or inference is a lie, as any sincere person can easily determine for himself if he has any desire so to do.

Let me reiterate what I said earlier. It is only a tiny fragment of the industry that is indulging in these high-binding tactics. The industry in general has been most understanding, co-operative and completely honest, but the deeds and words of a few recalcitrants can be and are damaging, to some extent at least, to the high standards so earnestly striven for by many high-minded individuals in both government and industry.

These observations of mine can be easily summarized as follows: We have a good government, the best in the world. We have a good industry, head and shoulders above any other, and we get along fine together except for a few misfits on both sides who at times do muddy the waters. As to the why of the misfits, I can't do any better than close on a bit of doggrel, which appears to fit the case.

The old queen bee is a busy old soul
She doesn't believe in birth control
And that is why beyond a doubt
There's so many sons of bees about.

* * *

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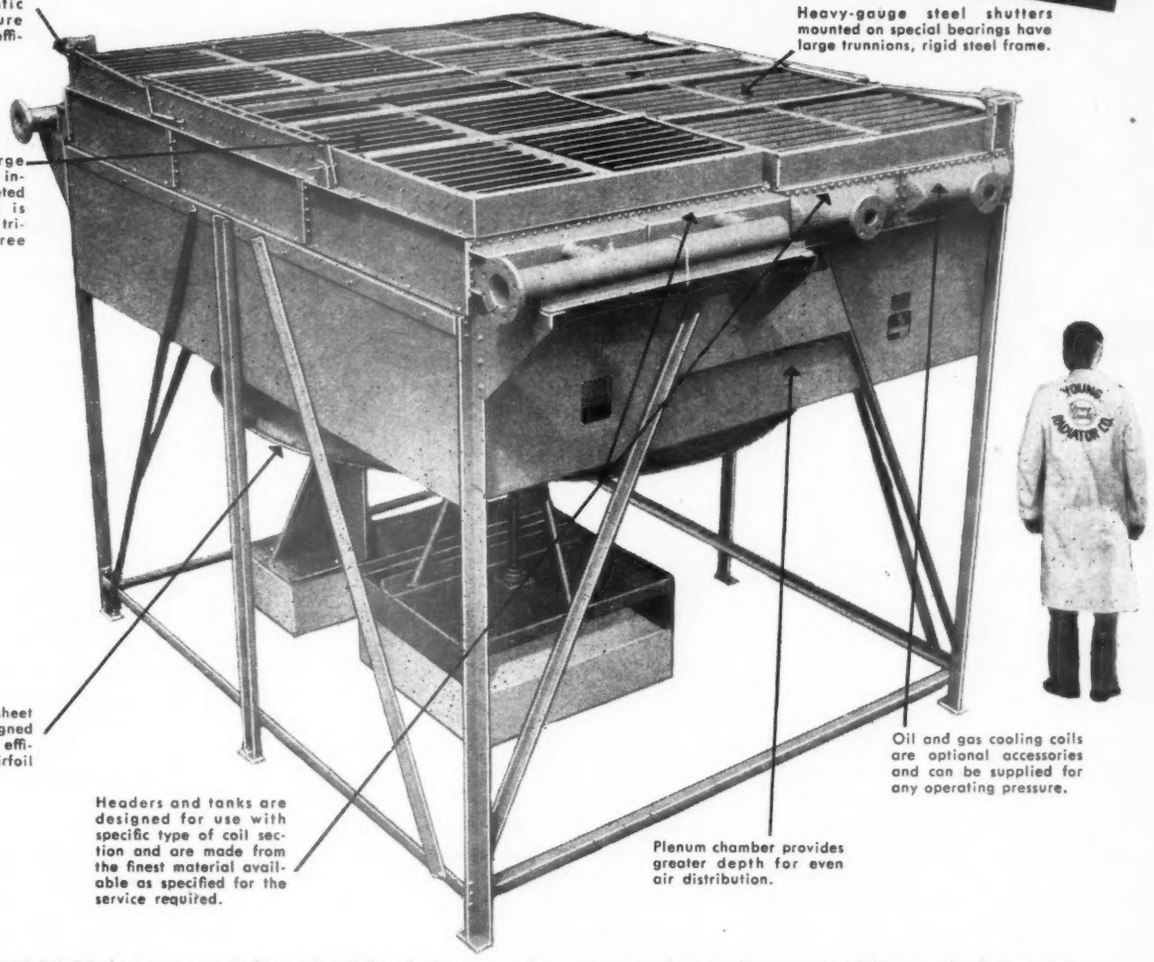
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To obtain more information on products advertised see page E-35

Werner Minton Adams Jordan Awty Whiteside Evans Thompson Keathley Smith

Pictured above are guests at a luncheon honoring petroleum women in Dallas recently.

Oil Women Form Own Organization

Desk and Derrick Club chapters have sprung up throughout the United States and Canada and may soon become world-wide

MARY MORRIS*

SOMEONE once said, and wisely, "Never underestimate the power of a woman," and he might have added, especially a petroleum woman!

Had this olden day philosopher been acquainted with some of the modern oil women, he might have made his warning even stronger. For when Miss Inez Awty, of Humble Oil and Refining Company, decided she didn't know enough girls in the oil industry, things began to happen. Gathering about her some of these girl Fridays in New Orleans, Louisiana, the group got together at the local Petroleum Club for a little tete-a-tete after 5. Gradually faces were connected with voices long familiar to the girls via telephones. Amid the chatter, someone suggested forming a club and including all the women in the city who worked in the oil industry.

That suggestion, which was made with the thought of nothing more than a city-wide club, proved to be a spark that lighted the way for petroleum women all over the North American continent. In Jackson, Mississippi, the girls were clamoring to hear more about this club, which was appropriately named "Desk and Derrick Club." Soon they formed their own chapter, and last year Houston, Texas, founded its chapter with 58 charter members. Today the club has 325 members representing 110 companies. Then Los Angeles, California joined the parade. And so the four original chapters were formed, and the thing was becoming so large it was decided to get a national charter.

Besides the four original ones, chapters have been formed in Shreveport, Louisiana; Denver, Colorado; Ventura, California, and Calgary and Edmonton, Alberta, Canada. Nor is it stopping there. In Dallas, Texas, recently a Recognition Day for petroleum women was held, with luncheon, orchids, and a radio and television appearance highlighting the day. The girls wanted to hear more about the Desk and Derrick Club, and listened eagerly to its founder, Miss Awty.

Aside from the many secretaries, assistants, and junior executives in the city's oil business attending the luncheon, 6 outstanding petroleum women were given special honor. They were: Ernestine Adams, managing editor of The Petroleum Engineer; Alta Ewalt Evans, director of advertising and employees' relations, Southern Union Gas Company, (Miss Evans, an employee of Southern Union more than 21 years, organized the company's advertising department and is its first and only director); Kathleen Keathley, consultant in stratigraphic and paleontologic work; Claribel Thompson, editor for the employee magazine, Blue Blaze, for Lone Star Gas Company; Ethel O'N. Johnson, personnel director, Southern Union Gas Company, and Pauline McKinney Minton, president of the Speed Jet Oil Tank Service Company, Inc.

Fifty Dallas oil women met recently and put into action plans of a Desk and Derrick chapter in that city. Grace Smith, a long time employee of The Texas Company, was elected president. Other officers are: Virginia Dupies, Continental Supply, first vice president; Doris Whiteside, Texas Mid-Continent Oil and Gas Association, second vice president; Rosalie Jordan, OIIC, corresponding secretary; Marie Dee, Lone Star Gas, recording secretary, and Shirley Kyle, Cox and Cox, treasurer.

*Staff writer.

Los Angeles Desk and Derrick Club grouped around W. E. Glenn, regional petroleum engineer of Continental Oil Company, as he explains actual drilling practices at one of the many stops during the club's recent tour of Continental Oil Company's San Miguelito lease, in California.

Houston Desk and Derrick club on a field trip to Wyatt Metal and Boiler Works, Houston, Texas. Officers of the chapter are Elizabeth Quick, president; Dorothy Shatto, first vice president; Ellen Petitfils, second vice president; LaVina Femelat, treasurer; Jocie Caughman, recording secretary; Helen Guerin, corresponding secretary.

Directors are: Ernestine Adams, The Petroleum Engineer; Evelyn Bondurant, Magnolia; Virginia Lloyd, H. S. Moss; Vesta Prather, Sun Oil: Martha Binford, Seaboard; Ruth Castleman, DeGolyer and MacNaughton; Alta Evans, Southern Union Gas; Jaurea Johnson, R. L. Foree; Kathryn Kennell, Lone Star Gas; Ruth Potchernick, Atlantic Refining; Dot Wade, Jake L. Hamon, and Misses Smith, Dupies, Whiteside, and Mrs. Jordan.

So rapidly has the club caught on that international boundaries have been skipped and at the Third World Petroleum Congress recently held at The Hague, Mrs. Lucille Taylor of York Supply Company, Houston, Texas, represented Desk and Derrick. Following adjournment of the Congress, Mrs. Taylor toured Europe bringing back petroleum news and color pictures for the club.

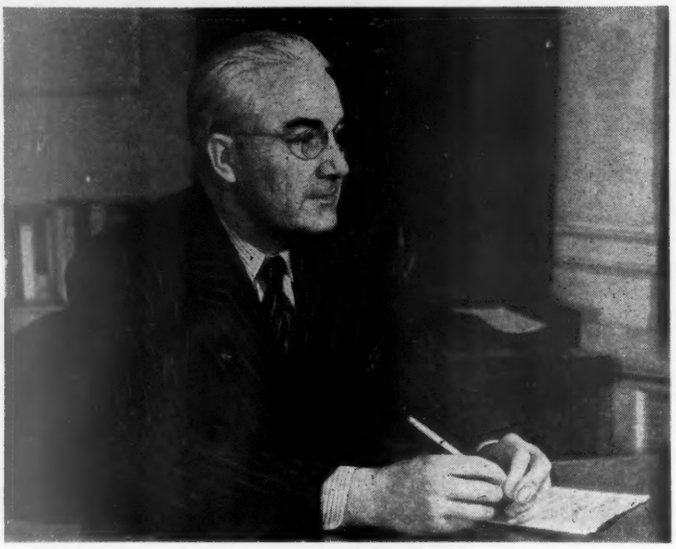
Possibly the greatest contribution to the oil industry that this club performs is teaching the girls the operations of the oil industry, so that they may apply this knowledge to their jobs. After months and in some instances years of writing letters about rigs, refineries, drilling barges, etc., the oil and oil supply companies are now showing these things to the girls firsthand. Club members make field trips out to the oil fields and watch seismic explorations crews, and drilling rigs at work; they visit refineries and processing plants.

Desk and Derrick is becoming an important force in employee relations and in public relations for the oil and gas industry. * * *

New Orleans Desk and Derrick girls, at right, on a field trip to Jefferson Parish where Bateman Drilling Company acted as host. This is just one of many similar trips taken by the original chapter of Desk and Derrick.

Jackson board of directors, left, holds a council meeting. They are: Helen Garellick, Harris and Payne, recording secretary; Nina Price, Carter Oil, treasurer; Aneva Stevens, Southern Natural Gas, corresponding secretary; Margaret Zomkowski, Honolulu Oil, vice president; Betsy Watson, Stanolind, director; Margaret Neff, Dixie Geological Service, past president; Irline Coen, Vaughey and Vaughey, president. Not pictured, Ruby Spencer, Magnolia, director.

PETROLEUM PROFILE



H. H. ANDERSON
Vice President and General Manager
Shell Pipe Line Corporation

A tall, robust man swings around at his desk to pick up his telephone in his office on the twelfth floor of the Shell Building in Houston, Texas. He is preparing an address for the Chelsea, Oklahoma, High School graduation. He asks for Chelsea Pump Station, and a moment later is saying, "What Shell children attend your high school?"

A direct man in everything he does, H. H. Anderson, vice president and general manager of Shell Pipe Line Corporation, is known throughout the Shell organization and much of the oil industry for his forceful personality and ability to get to the point of any matter. In addition, he has retained and developed his human qualities, as shown in his preparation of a high school graduation speech and his desire to recognize especially the sons and daughters of Shell employees. He has had 34 years with Shell in many varied capacities, since June, 1941, as vice president and general manager of Shell Pipe Line.

Born in Portland, Oregon, Anderson attended the University of Southern California, receiving in 1915 a BS degree in electrical engineering and in 1916 a master's degree in physics and mathematics. He continued postgraduate work for a Ph.D. at the University of California.

In May, 1917, he gave up completion of his Ph.D. thesis to work with Shell in the California oil fields as field engineer at Coalinga.

By 1925 he had advanced to chief engineer (mechanical) of Shell's West Coast production department. In 1931 he was moved to New York as assistant to president of Shell Union. A year later he was made a general vice president of Shell Oil's predecessor company, Shell Petroleum. He joined Shell Pipe Line in 1941.

Special jobs appeal to Anderson. During World War I he earned a commission in the Army Signal Corps by developing the formula still used to compute the ascensional rate of meteorological balloons. In 1922 he conducted the first extensive investigation of the properties of oil-well drilling muds. He helped design the first API sucker rod thread. He developed the "ton-mile formula" used since 1927 as a yardstick of wire rope service. He was an early advocate of oil field electrification, and introduced electric- and diesel-driven rotary drilling in California.

In 1929 Anderson supervised erection of Shell's 30-story office building in San Francisco. For a year during NRA days he served in Washington as chairman of the Oil Code Authority's Labor Committee. The year 1935-36 was spent with "El Aguila," Shell's affiliate in Mexico; the last six months as co-manager of operations. In 1939 he was again in Washington as one of the group of eight executives selected to present the petroleum industry's story to the government's Temporary National Economic Committee.

For outstanding service to the American Petroleum Institute, in 1950 Anderson was awarded the Institute's Certificate of Appreciation. He is an old-timer in the Division of Production, and in 1928 was chairman of its Committee on Oil Well Drilling Practices. Since 1944 he has been vice chairman of its Committee on Standardization of Oil Country Tubular Goods. In the Division of Transportation he is a member of the Committee on Pipe Line Transportation, and since 1945 has been chairman of its Committee on Pipe Line Technology.

Under API's new Division of Technical Services, in 1950, Anderson was named chairman of the Committee on Code 25 — "Measurement, Sampling and Testing of Crude Oil." Last year he served also as chairman of an interdivisional Special Committee on Vocational Training, and as a member of the Interdivisional Conference on Codes and Standards.

As an advocate of corrosion prevention, Anderson in 1947 was elected chairman of the eleven-industry Correlating Committee on Cathodic Protection. He has been a director and also vice president of the National Association of Corrosion Engineers.

Asked how he has been able to handle so many "extra-curricular" jobs, Anderson replied: "I have always been fortunate in developing assistants who learn to do the regular work better than I can, and in having the good sense to let them do it." Nonetheless, he contributes his share to the smooth functioning of the Shell organization.

An ardent champion of industrial safety, which he believes stems from good employee morale, Anderson has led Shell Pipe Liners during the last four contest years to win three first-place awards and one second from the National Safety Council for Group A, Oil and Gas Pipe Lines. He is on the Labor-Management Committee of the President's Conference on Industrial Safety.

Anderson enjoys his work in Shell Pipe Line because his life-time friend, President T. E. Swigart, gives him full latitude to apply the knowledge and experience gained in his many administrative assignments. Perhaps, best of all, he can implement and demonstate the truth of the motto of *Shell News* he wrote in 1937: "The interests of employee and employer are mutual and inseparable."

Breeding More Controls

WHEN you put in your request to PAD for oil country tubular goods for the third quarter did you ask for three times as much as you used a year ago in the same period? If you did you were average.

There were 4000 requests for tubular goods, asking for 300 tons as an average or a total of 1,200,000 tons, according to an interesting and objective report of A. P. Frame, assistant deputy administrator for the Petroleum Administration for Defense. (See Page A-53.) This was 3½ times the amount of steel available. One operator put in a request for 100,000 tons, which would have given him the materials for one-fourth of all the wells that would be drilled in the third quarter.

Here is a picture of greed that fits so well into the canvas of the pseudo-liberal. This is the kind of situation that breeds more controls because it seems to prove that allocations are the only fair method of distribution. Very few persons outside the oil industry will look at any other view of the facts.

In the first place some 600 applicants had no previous drilling history. They just wanted some tubular goods. The oil industry, of course, is not responsible for these opportunists but an unfriendly critic is not likely to bother about such a detail. Next, the oil industry has been told time and again by the military and other federal officials that we need another million barrels of oil production a day. Whether the oil industry heard the exact limitations on tubular goods or not, it heard about the added production needed and knew that to have more production we had to have more drilling. Virtually every operator enlarged his drilling program.

Another point is that the allocation of materials based on previous performance of a company is directly against the enterprise system, which allows a company to progress as fast and as extensively as it is able. It also effectively discourages new companies from entering the field.

Without controls the acquisitive operator may get stuck with an outsize inventory so he limits his buying to his needs. Under a control system the responsibility for the amount of materials purchased has a tendency to be shifted from the individual company to the government.

With the results of this last multiplying of steel needs in mind, the oil industry will doubtless show more restraint in its requests for tubular goods in the fourth quarter. Right now we have to endure controls as best we can but we can still work for the time when controls will not be necessary and the operator who wants 100,000 tons of tubular goods can have every ton if he can pay for it.—E. A.

Now You Can Set these Two

BAKER MODEL "D" RETAINER PRODUCTION PACKER PRODUCT NO. 415-D

We realize that your choice of setting method is important, but before we consider the relative advantages of setting methods, let's first analyze the end results obtainable with these tools after they are set.

Among the important advantages of the Baker Retainer Production Packer are its uses . . . for production of one or more zones, simultaneously or separately, for acidizing, for re-pressuring—in fact for every application possible for a packer of its type.

Features which appeal to veteran production men are its Complete Drillability—Resistance to High Temperatures—Corrosion-Resistant Construction—Freedom of the Tubing from the Packer—and Positive Anchoring against Upward or Downward Movement—Bottom-Hole Control with a flapper valve which closes when the tubing is removed, thereby eliminating necessity for killing the well with mud, under normal well conditions.

The wide range of applications, permitting almost unlimited flexibility of subsequent operations, is based upon the construction of the packer itself which employs two sets of opposing slips with a Buna N Rubber packing element between them. When it is set the Packer virtually becomes a part of the casing, cannot be moved up or down, and prevents fluid or gas from passing between the packing element and the casing.

When the Setting Tool (used to set the Packer) is removed from the well, only the smooth-bore Packer remains, securely packed-off, ready for selection and use of the proper Baker Packer Accessory Equipment to meet your production requirements.

It is the extensive line of Accessory Equipment which permits installations to produce from one or more zones, as desired, through tubing or casing—and production changes often can be made without pulling the production string. Complete details of hook-ups, and illustrations of many unique, as well as routine installations, are contained in an 84-page Baker Packer Brochure, gladly sent to you upon request.

SET ON TUBING OR A WIRE LINE

In addition to conventional setting on tubing, the Baker Retainer Production Packer (Product No. 415-D) can be set on an electrical conductor cable by leading service organizations. See listing on opposite page of the organizations in your area, ready to give you prompt, resultful service.

BAKER OIL TOOLS, INC.
Houston • Los Angeles • New York

Baker Retainer Production Packer

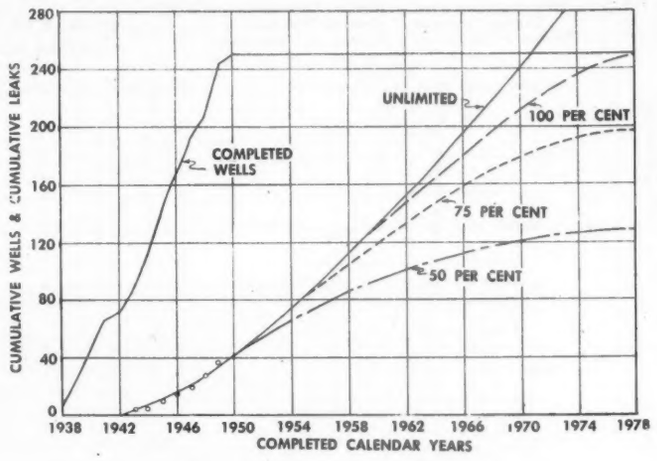


FIG. 1. Predicted failures.

Casing Failures Traced To Bacterial Action

RICHARD SNEDDON*

THE widening role of the bacteriologist in the diverse phases of petroleum operation received another decided fillip recently when it was announced that researches conducted by Keith Doig, young Shell Company engineer, in collaboration with Dr. A. Wachter of Shell Development Company, had definitely traced a series of casing failures in the Ventura Avenue field to the depradations of sulphate-reducing bacteria, *sporovibrio desulfuricans*. This conclusion was reached after the most meticulous examination of all the involved circumstances and some very clever deducing. As a matter of fact success came largely as the result of eliminating, after the manner of Sherlock Holmes, all the possible culprits and then, with only one left, proving by applied logic that this was the guilty party.

The problem has exercised operators in the Ventura Avenue field for some considerable time. The first casing leak reported as definitely attributable to corrosion occurred in 1943 and it is estimated that in the intervening years there have been about 75 or 80 more wells affected. Shell Oil Company alone reports some 40 failures in the area and on the basis of information, which will be referred to later, it is predicted that approximately 180 of the 250 wells, drilled between 1938 and 1950 will still develop corrosion failures unless some unforeseen change takes place in the prevailing trend.

It appears that in the early days when the Ventura wells were drilled by cable tools, multiple strings of casing had to be used to hold in control the high pressure of the shallow zone then penetrated. Later, even when rotary drilling became the order of the day, it was customary to use an extra string of casing. This was true of most wells completed prior to 1932. After that date and up to 1940 many wells were completed with a single string, and subsequently the single string jobs numbered about 90 per cent of the total drilled. It is in these single string wells that corrosion failures are noted.

An interesting fact in the light of later discovery is that mud had not been subjected to chemical treatment prior to 1934, but at that time treatment with caustic soda-quebracho-sodium silicate came into use, and the result was an approximately 10 pH mud. From 1938 to 1940 the treatment was changed to phosphate-quebracho, which produced a mud with a pH of about 8.5. Casing could not be pulled, of course, and it was thus no easy matter to distinguish corrosion leaks from thread leaks, splits, and other mechanical failures, but those that were in any way doubtful were not taken into consideration. The leaks that occurred in the body of the pipe, however, exhibited characteristics that made their nature quite certain. Cementing tools passed the affected areas easily and could be set close enough to show that the actual holes were small. As there was practically no external corrosion of tubing it was concluded early in the investigation that the casing corrosion was external.

Ordinarily, leaks are detected either in a blow of gas or oil outwards through the casing, or by the influx of sand, mud, or salt water. In either case as soon as the leak is found the well is mudded off, because a small stream of high pressure sand and salt water can soon bite its way through the tubing. Also the tubing may sand up and stick, particularly if it extends into the liner. Where the leak results in an escape of gas or oil from the inside, it may cause a blowout through the annulus between the casing and the hole.

The procedure for repairing leaks has been very satisfactory. Of the 40 Shell Company wells already mentioned as having developed corrosion leaks, 38 showing 45 corrosion leaks in the body and 9 leaks in the vicinity of the collars, were successfully cemented with a straddle tool to withstand a pressure of 1500 psi. The leaks occurred at varying depths from 905 to 7085 ft, and none of the wells so repaired have developed further corrosion failures. Incidentally, it is estimated that after original completion of the wells, the average time that elapses before failure occurs is 4½ years and it ranges between 1 year and 11 years.

Fig. 1 shows the prospective corrosion failure rates based on the limited available data so manipulated as to discount the effect of recent well additions. Curves are extrapolated on 4 hypothetical conditions and the 75 per cent failure curve was selected since accumulated evidence indicates that the true line must be between the 100 per cent failure line (which has to be eliminated because there have been no repeat failures so far) and

*Pacific Coast Editor.

EXCLUSIVE

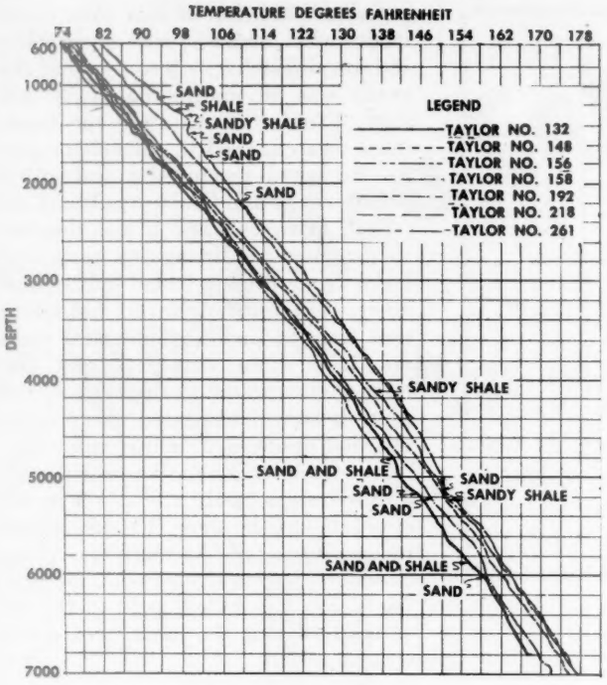


FIG. 2. Temperature survey curves.

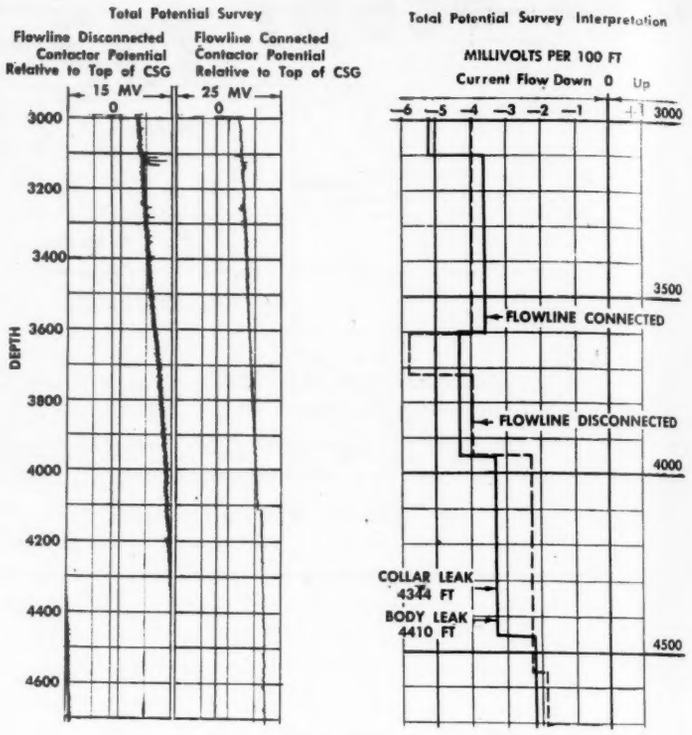


FIG. 3. Typical total potential log.

the 50 per cent line (which must also be eliminated because some well groups have already shown a failure incidence that high).

Efforts to determine the cause of corrosion gradually ruled out the possibility of corrosion components in the subsurface strata, defective steel, electric currents in casing or flow lines, and interzonal migration of salt water. Indeed, examination of the facts disclose no correlation between the corrosion leaks and any known stratum or condition. An effort to trace the effect of migrating salt water showed minor departures from the normal temperature gradient, and it is interesting that recent attempts to locate leaks through temperatures surveys also showed irregularities in the temperature gradient (see Fig. 2) but the variations were not deemed consequential. The electric current theory was tested first by a specially devised tool consisting of a single electrode run on standard electric logging cable, and brought into contact with the casing by means of sliding, spring-loaded, knife edges. A sample of the continuous recordings of electrical potential by this device is shown in Fig. 3.

Lack of satisfactory results with the single electrode stimulated the development of a two-electrode tool for gauging the difference in potential across a fixed span. This device is shown in Figs. 4 and 5, and consists essentially of two modified slot-cleaning tools. As measuring electrodes they are hung 50 ft apart on electric logging cable, and contact is made as before with spring-loaded blades. A procedure has been worked out for this improvised instrument that makes it very effective. The current input contractors illustrated in Fig. 6 are used to deliver a measured current across the measuring electrodes, hence, the resistance between the electrodes can be easily determined.

The entire electrical potential survey, however, although intensely interesting was productive of nothing that was positive in the search for the cause of this particular corrosion. Tests run on two Taylor wells are shown graphically in Fig. 7 and 8. The former also shows the results of a survey after the well was cemented, made to confirm the belief of the experimenters that cementing caused a change in current distribution. It will be noted that the Taylor 157 curve before cementing shows that current is entering the casing in the vicinity of the leak. The curve from Taylor 169 (Fig. 8) shows current leaving the casing near the leak. Reference to

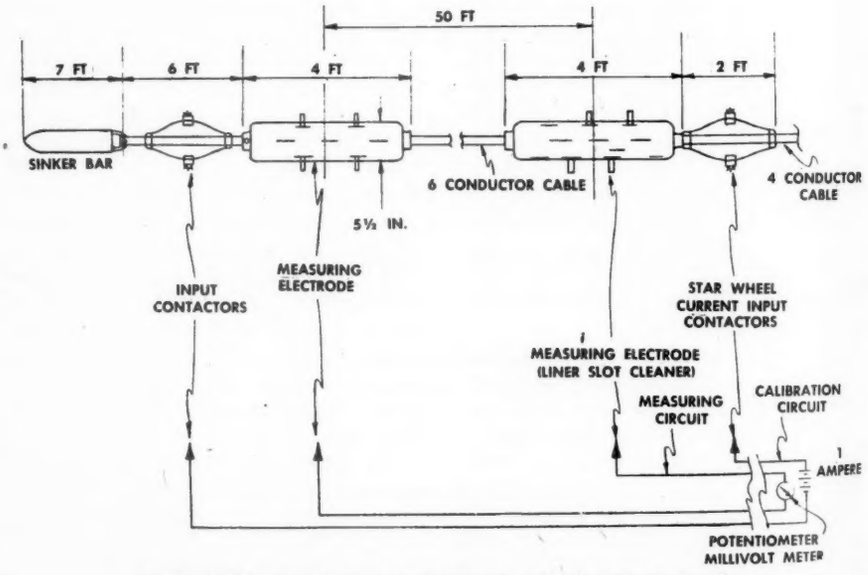


FIG. 4. Current survey tool layout and electrical circuits.

Fig. 9, however, which is a plotting of results taken at 10-ft intervals shows the proper current distribution and does not show any loss at the leak. The explanation for this apparent discrepancy is that readings taken with the surveying instrument are a summation of conditions between electrodes and not the precise condition at any single spot. Fig. 10 shows what might be expected if a flow line current were responsible for corrosion, and apparently nothing like this was found.

The investigators next began to consider preventive methods, but that was not easy to do very logically when the cause of the corrosion still remained a mystery. There was the further discouraging fact, too, that it might take 5 or 6 years, after application of the remedy to find out whether or not it had been effective. Then there was always the danger that any actual effort in the field to counteract corrosion might merely aggravate the entire situation and perhaps even do irreparable damage to the wells.

The insulation of flanges on the flow lines and other well head connections to prevent the introduction of subsurface currents was abandoned as a preventive measure of little value in this instance. Tests also indicated that cathodic protection for existing wells did not offer a desirable preven-

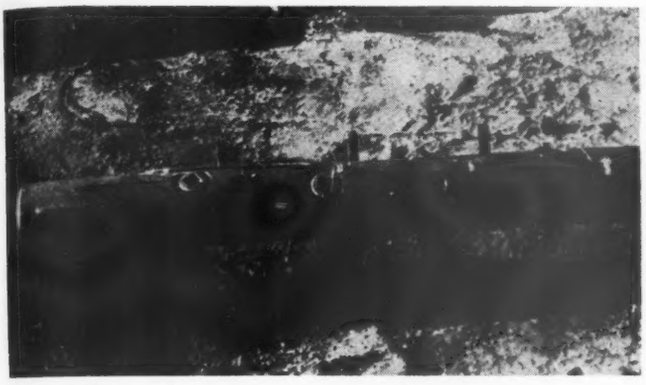


FIG. 5. Current survey measuring electrode.

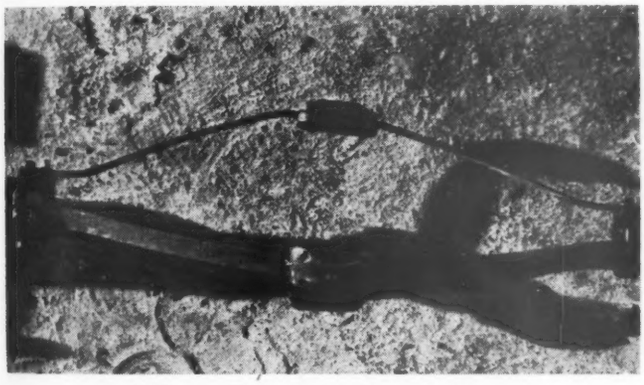


FIG. 6. Current input contactor.

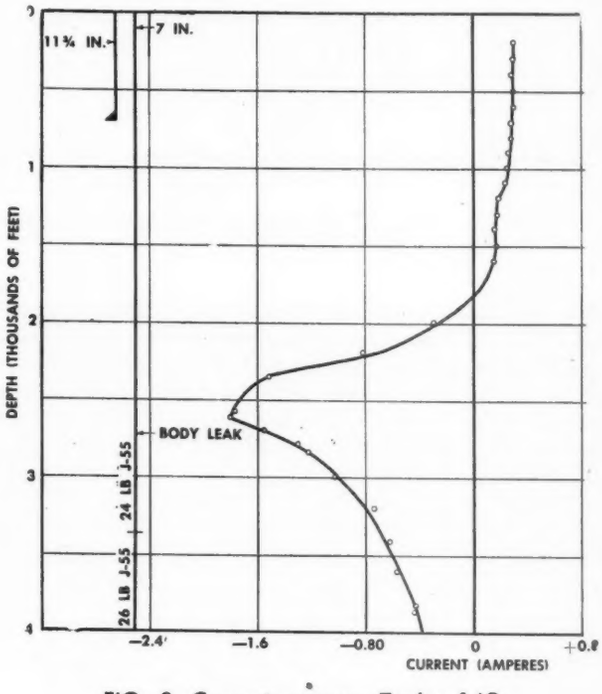


FIG. 8. Current survey—Taylor 169.

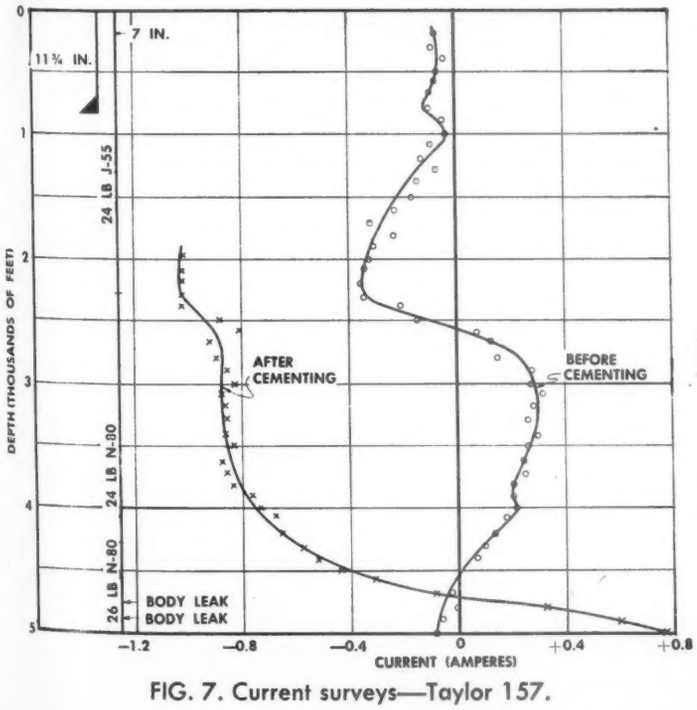


FIG. 7. Current surveys—Taylor 157.

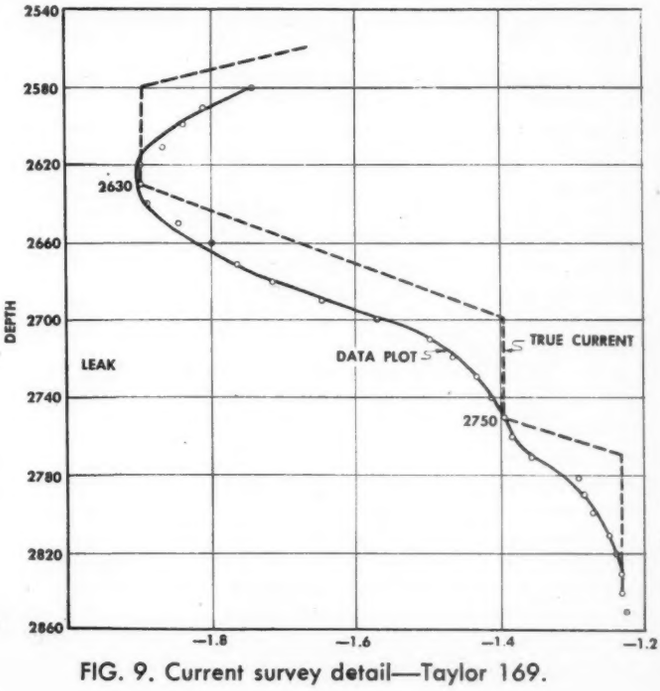


FIG. 9. Current survey detail—Taylor 169.

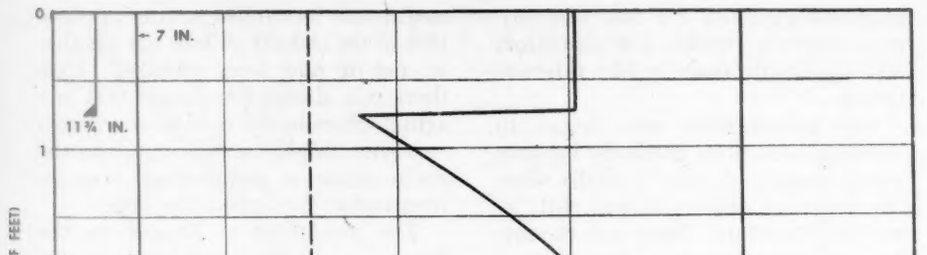


FIG. 10. Illustration of hypotheical flowline effect.

tive because the flow of current upward through the water string would jump to the surface pipe and at that point undoubtedly cause severe corrosion. In addition, the effective depth of cathodic protection is not sufficient and even if it were, would be uneconomical in a deep well because of excessive power requirement. Tests were conducted on Taylor 148 using two anodes, and a welding machine as the source of direct current. The circuit of the set-up is shown in Fig. 11 and plots of the data, with and without cathodic protection, are shown in Fig. 12.

Other methods of preventions were also considered but they blinked badly in the searching light of logic and were given up. Among those were protective coatings, combination of coatings and cathodic protection, protective strings of casing, filling the annulus behind the casing with oil-base mud, employing corrosion inhibitors, and the application of full string cementing. Only organic components were used in the protective coating tests. A standard coat of high temperature coal tar enamel was used on two joints of drill pipe, which were lowered to 7500 ft on a drill pipe string. When pulled from the hole it was estimated that about 15 per cent of the coating material was gone and the remainder had been softened to the running point by high wall temperatures. A second test employed on high temperature, specially prepared, coating of the same type, in this case one joint being given a single and one a double coat. They were lowered to 8000 ft after being tested by a holiday detector and recoated where necessary. When withdrawn the single coated sample had suffered considerably, but the double coated one showed only two spots at which the coating had been penetrated to the pipe. It was feared, however, that these exposures might serve to concentrate the corrosion. A photograph, Fig 8, shows some of the damage.

Cathodic protection in combination with a coating was ruled out because it was thought that stray currents might jeopardize adjacent wells having no such protection. Scarcity of casing and high costs precluded the adoption of extra casing strings. Lack of permanence was perhaps the main reason for discarding the idea of using oil base mud in the annulus between the casing and the wall of the bore. Experience had indicated that fluids left in this annulus are often displaced by salt water. Inhibitors, it was agreed, would be very costly in the quantities required and would also likely dissipate in time. In addition they are detrimental to the physical properties of drilling fluids, and to begin with the exact nature of the corrosion would have to be known before the proper inhibitor could be decided upon.

An annular sheath of cement outside the casing was thought to offer possibilities of economical corrosion prevention. Best results have been obtained with a light cement string, weighing about 85 lb per cubic foot and having the following properties:

TABLE 1. Properties of lightweight cement.

Density	85 lb/ft³
Bentonite	15 per cent by weight of cemen
Water	2.8 ft 3/sack of cement
Slurry volume	3.1 ft 3/ sack of cement
Stormer viscosity	220 grams
Compressive strength (5 days)	200 psi
API thickening time	4 hours

Nineteen full string cement jobs were completed with this material, the deepest at 10,699 ft. Circulation was maintained all the way and cement returns were noted at the surface. This system is, of course, only effective in new projects, and is of distinct value but has been neutralized to a great extent by later findings.

The actual cause of corrosion was really brought to light after a piece of corroded casing was recovered

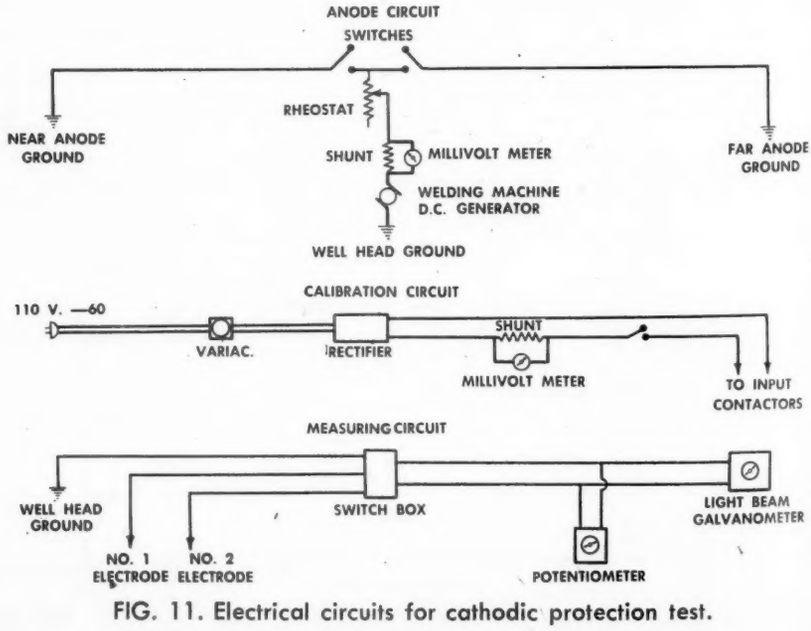


FIG. 11. Electrical circuits for cathodic protection test.

from Taylor 132. This well was completed with 11¾-in. surface casing cemented at 701 ft, a water string of 7-in. T & C, flash-welded pipe cemented at 6800 ft, and a 5-in. liner from 6774 to 8252 ft. A leak in the 7-in. casing had been noted about 8 years after the completion of the well when an influx of salt water and sand stuck the tubing in the liner. The leak was located at 2395 ft. This being relatively shallow it was determined to extract the casing and develop more information. Accordingly, the latter was washed over and recovered to a depth of 2532 ft. Samples of the formation adjacent to the leak were also recovered as were scale from the corroded areas, mud coke adhering to the casing, and drilling fluid used in the washover operation, all of which were carefully analyzed.

Examination revealed practically no internal corrosion, but the joints below the shoe of the 11¾-in. casing showed evidence of external action. The actual leak as indicated in Fig. 15 was oval shaped and centered in a section about 4 ft in length, where most of the pitting was on the same side as the leak, although one deep pit showed about 150 deg round the pipe from the leak. The hole appeared to have been eroded by the action of salt water and sand and there was no evidence of relation between the seam and the corroded areas, so it was concluded that the latter corresponded to contact of the casing with the wall.

The mud cake adhering to the casing had a pH of 8.3, the same as the mud originally used to drill the well. Examination of the corroded casing disclosed no metallurgical deficiency and no heterogeneities that might have been responsible for exciting or accelerating corrosion. But (and

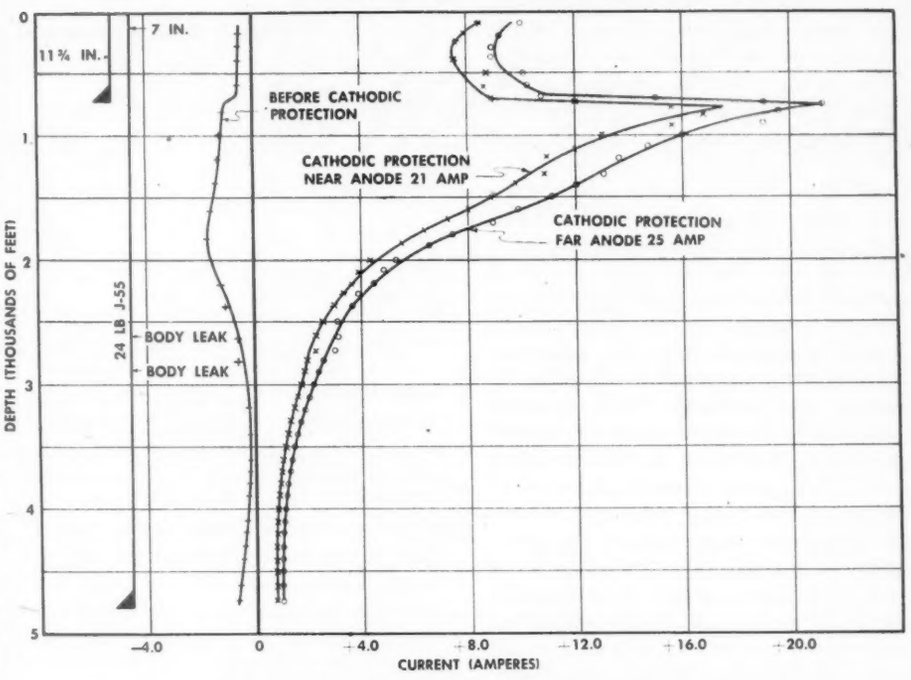


FIG. 12. Cathodic protection test—Taylor 148.

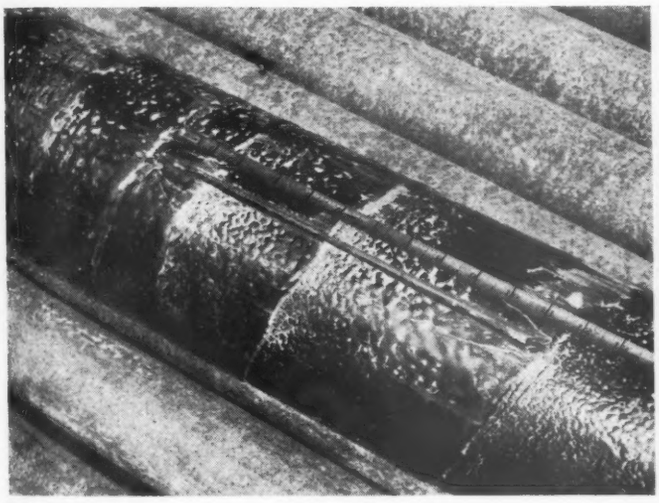


FIG. 13. Scratches on coated casing.

FIG. 14. Corroded casing from Taylor 132.

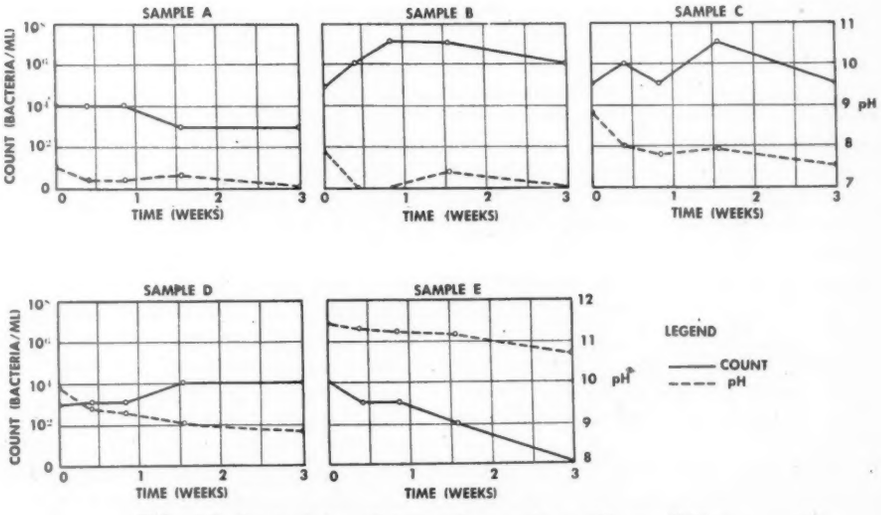


FIG. 15. Bacterial activity under various pH conditions.

here's the rub!) chemical analysis of the main corrosion product, a brittle black scale, showed it to be of similar composition to that reported in instances where sulfate-reducing bacteria were known to be the main cause of pipe line corrosion. See Table 2.

Neither the steel in the pipe nor the formation water in this field are sufficiently high in sulfur content to account for the high percentage of ferrous sulfide noted, and it is reasonable to assume thus that the necessary sulfur is derived from the reduction of sulfates present in the earth, water, and drilling fluid. Another suspicious circumstance is the limited presence of iron in the ferric state, which discloses virtual absence of oxygen, hence the proper environment for the activation of the anerobic sulfate-reducing bacteria. It is also significant that in non-acidic aqueous media, corrosion does not take place when no oxygen is available, unless some depolarizing medium such as bacteria is present. The accepted limits of activity for these bacteria are in the pH range from 5.5 to 9., so analyses of the mud cake fits neatly into the picture.

The localized nature of the affected areas is typical of bacterial action, too, and statistical data may be developed in support of the other evidence. The corrosion problem is serious only in those wells drilled after the phosphate-quebracho treatment was introduced. The transition period was from 1938 to 1940. After that the caustic-soda-quebracho-soda ash-sodium silicate method was used and the pH of the mud was fairly consistently about 8.5. This fact corresponds neatly with the inception of the casing corrosion trouble.

Bacteriological analyses of samples of pipe scale, residual mud cake, and five sidewall cores from Taylor 132, plus salt water from the 3427-3625 interval in Gosnell 38, and mud from the Taylor mud reservoir, were completed. The residual mud cake, the reservoir mud, and the salt water gave positive indications of the presence of sulfate reducing bacteria within a week, indication that the bacteria were both numerous and active. The pipe scale and sidewall cores showed positive results in three weeks, which is also comparatively fast for this type of incubation. The presence of sulfate reducing bacteria in these samples, coupled with the other substantiating data, seems to justify the conclusion that bacteria are responsible for the casing corrosion.

With this fact established, it becomes possible to develop preventive measures with rationality. In existing wells the problem is not a simple one since it would be difficult, and expensive to alter environmental conditions behind the casing. In considering the efficacy of treatment with gamma rays, neutron and ultrasonic radiation, it was concluded that the energy requirement was much too high, and some thought has since been given to the possibility of changing the pH outside the casing by applying heavy charges of direct current.

In the case of future wells, on the other hand, certain operational modifications seemed to suggest themselves. Failures had not occurred in those wells drilled when high pH mud was the vogue. It could thus be rationally assumed that such muds were inimical to the development of the bacteria that were causing the corrosion, and that their use in future wells would eliminate bacterial corrosion. Tests were conducted to determine whether or not there were incidental objections to the use of high pH mud and also whether or not Dent clay, a local product, could be used as a base for it. These tests established that the Dent clay was eminently satisfactory and that the high pH mud had a number of distinct advantages over the lower pH muds formerly used.

The effect of the high pH muds in limiting bacterial activity was also confirmed by test. It has been known that beyond a pH of 9 in aqueous media no action takes place, but whether or not this applied in a drilling mud had not been determined. Five samples of mud showing pH from 7.5 to 11.0 at the time of testing, were innoculated with active sulfate-reducing bacteria cultured from the pipe scale and sidewall cores taken from Taylor 132. Results of these tests are shown in Fig. 15. Most important is the fact that in sample E, the only one whose pH remained above 9.5 throughout the test, bacterial activity stopped entirely in three weeks. In all others there was either continuous action or it started when the pH had dropped sufficiently low. These results were confirmed by subsequent repeat tests and, of course, themselves confirmed earlier conclusions arrived at by simple deduction that high pH drilling fluids inhibit bacterial growth. With this definitely established the adoption of high pH muds for drilling new wells in the Ventura Avenue field was decided upon.

It might be mentioned that some study has been made of the effects of bactericides in high pH muds and although the investigation has not been concluded, there is already some indication that the bactericides do not add to the effectiveness of the mud itself as an arrester of bacterial action. It is possible, however, that they may do so in the case of low pH muds, but that has yet to be determined. One of the complications in this development is that most bactericides destroy the desirable qualities of a drilling fluid.

Needless to say the work is still going on. In fact, it has probably been considerably expanded in the past few months, since undoubtedly it has excited considerable independent study of the pH value and its relation to drilling and production problems. Meantime, it is reported that the change to high pH value fluids in the initial drilling effort is already paying off in lowered drilling costs, fewer fishing jobs, better carrying power, and generally fine performance.

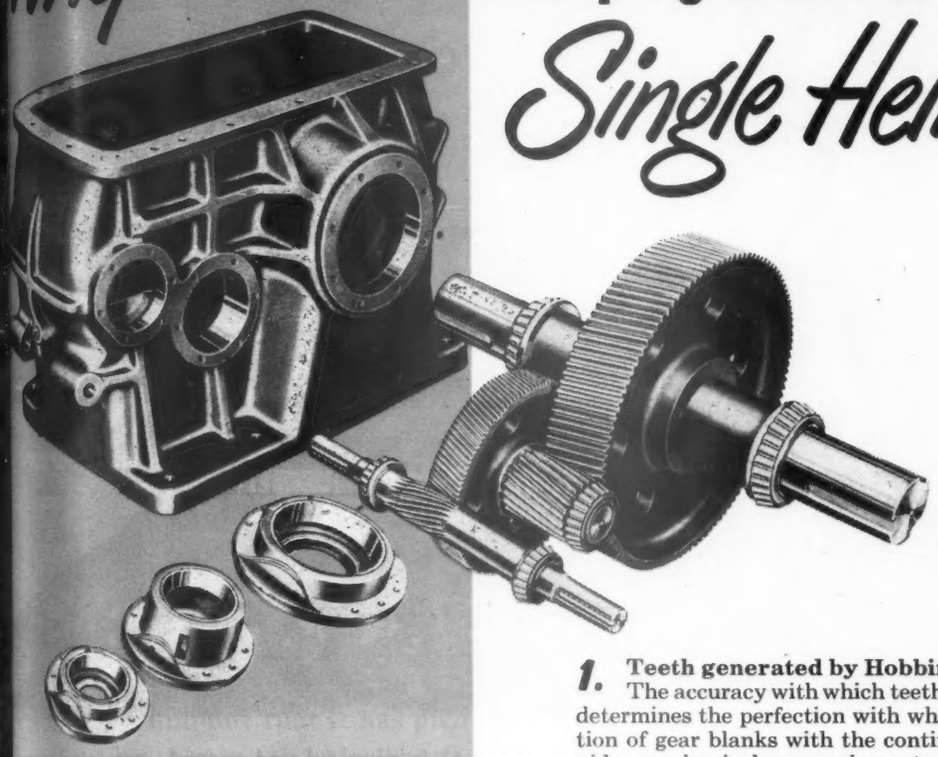
In tracing down these predatory microbes, Keith Doig, assistant mechanical engineer for Shell Oil Company at Ventura, and Dr. Wachter, Shell Development Company, have had the aid of metallurgists, biologists, bacteriologists, and other specialists from the latter organization. They have consulted with Dr. Claude Zo Bell, Scripps Institute of Oceanography, whose first disclosures of the role of bacteria in the genesis of petroleum created quite a sensation a few years ago; and have made full and profitable use of all the facilities at their command. In his field work, Keith Doig has been under the immediate direction of Horace Hindry, Shell's division mechanical engineer.

* * *

TABLE 2. Comparison of corrosion product analyses.

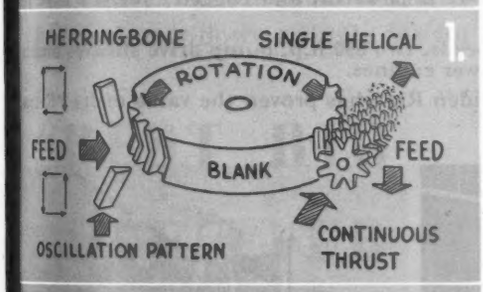
Component	Analysis of casing scale	Reported analyses of bacterially corroded buried pipe lines- No. 1	No. 2	No. 3	Calculated composition of casing scale	
S^{--}	1.38%W	1.71	1.92	1.15	FeS	6%W
SO_4^{--}	0.31	0.90	1.32	None	$FeCO_3$	53
$BaSO_4$	0.3	.....	.....	.....	$Fe(OH)_2$	16
Total S	2.7	2.06	2.44	1.20	Hydrocarbon	2
F^{+++}	0.6	0.1	1.4	2.1	Acid. insol.	11
Total Fe	38.8	34.0	28.4	39.6	Unaccounted	12
CO_2	20.3	8.4	10.6	18.0		100
C (wet oxid.)	7.3	.....	.....	.....		
Acid insol.	10.6	.....	.....	.....		
$SiO_2 + Al_2O_3$	.....	32.6	42.1	12.6		

Why "Oilwell" Pumping Units are built with *Single Helical Gears*

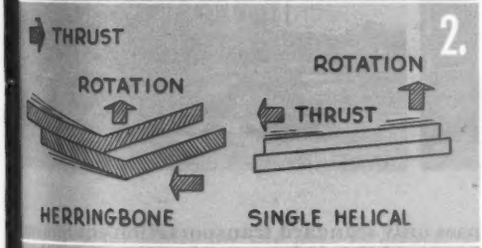


IN PUMPING UNIT GEAR TRAINS . . . the exactness with which teeth mesh and the permanence with which bearings operate at factory-prescribed tolerances, determines the service life which can be expected from this important part of your pumping unit.

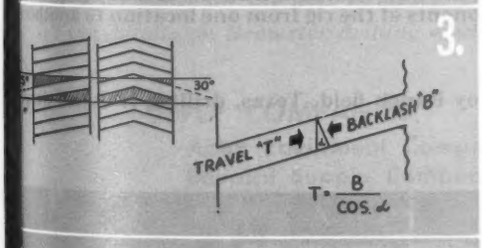
"Oilwell" design engineers use single helical gears mounted in tapered roller bearings because they have the following inherent advantages:



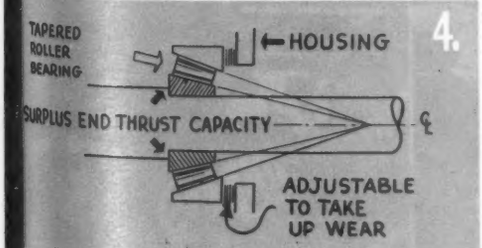
1. Teeth generated by Hobbing Process are extremely accurate. The accuracy with which teeth are spaced and their profiles are formed determines the perfection with which gears mate. Synchronizing the rotation of gear blanks with the continuous direction of the cutting hob provides mechanical accuracies not possible with the shaper process which must oscillate back and forth to produce continuous tooth herringbone gears.



2. Uniform tooth loading results in uniform tooth wear. With single helical gears, teeth come into contact with a rolling action which travels progressively across the gear face, causing uniform deflection of all segments of each gear tooth and maintaining factory-perfect tooth profiles even after wear. The V-stiffened center of herringbone gears cannot deflect like the rest of the tooth, so uneven tooth loading results in uneven wear. Furthermore, the minutest variation in alignment causes one side or the other of herringbone gear teeth to carry all of the load. Although shafts are generally floated in straight (non-adjustable) bearings, loads are carried momentarily by one of the other wings of the V, causing excessive tooth stress.



3. Low helix angles result in lower shock loads from backlash. Shock or impact loads increase by the square of the travel distance between mating teeth; so "Oilwell" single helical gears are built with low helix angles of from 10° to 15°. At a given backlash, impact loads of 15° single helical gears are from 91% to 80% of impact loads on herringbone gears having helix angles of from 23° to 30°.



4. Tapered Roller Bearings can be field-adjusted to maintain correct shaft-center distances. The stress reversals of pumping units build up the backlash and impact loads as wear occurs on gears and bearings. Since herringbone gear shafts float in non-adjustable bearings they have no provision for maintaining factory-prescribed tolerances. Tapered-roller bearings are designed so that projected taper-angle lines of the rollers meet at the shaft center. Therefore, as bearings in the gear train are returned to their factory tolerances by shim adjustments, shaft centers are maintained at their original distances. Tapered construction also provides end-thrust capacity far in excess of the end thrust generated by low helix angle single helical gears.

ASK . . . your nearest "Oilwell" Representative for a copy of our Single Helical Gearing Handbook . . . or write for Pumping Unit Booklet No. 14-51.

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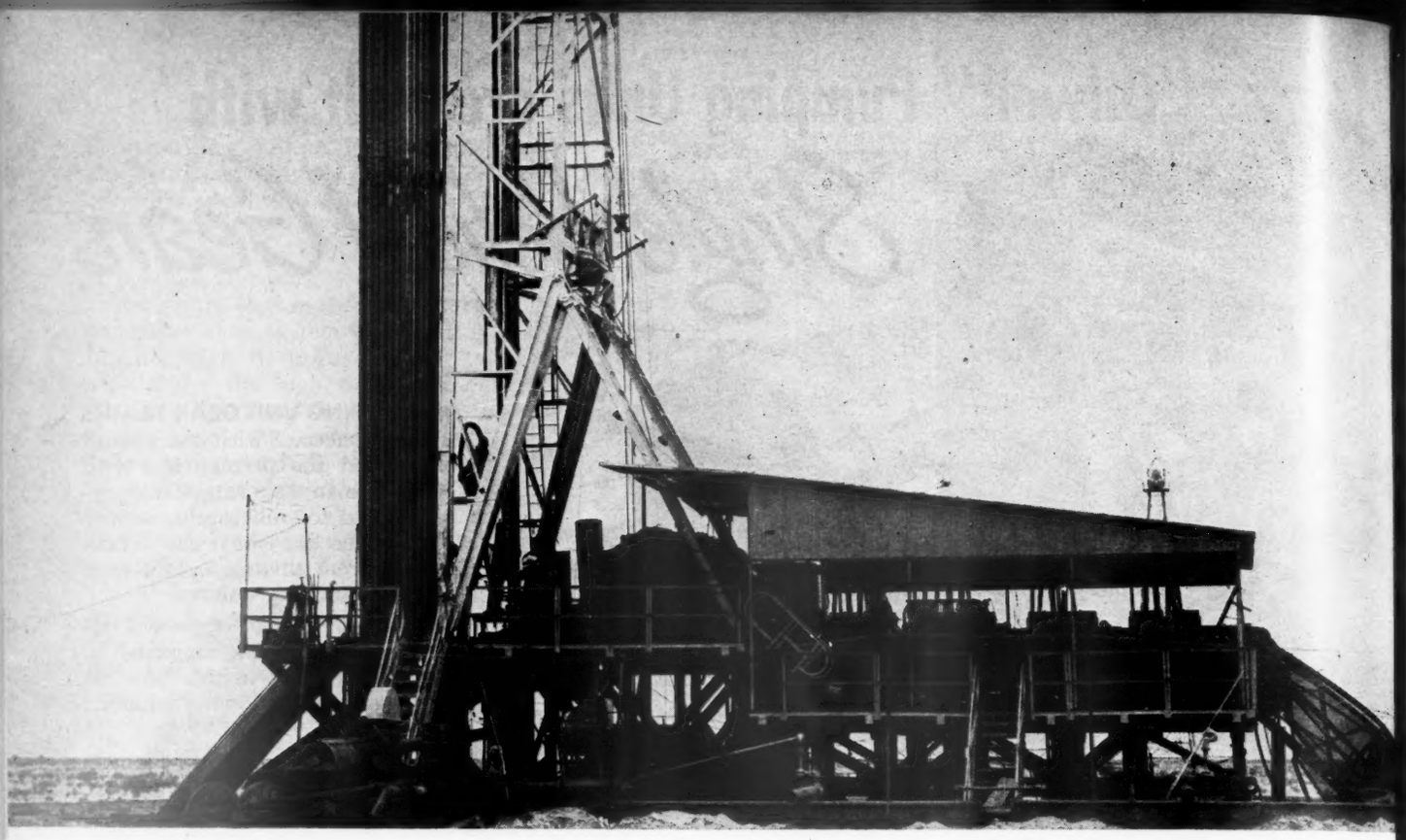


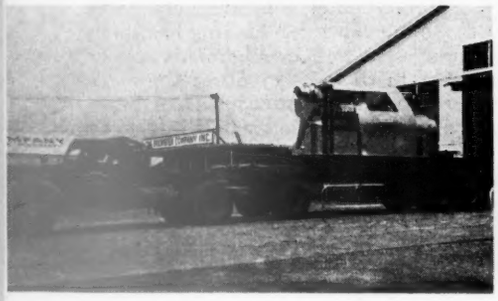
BREWSTER N-12

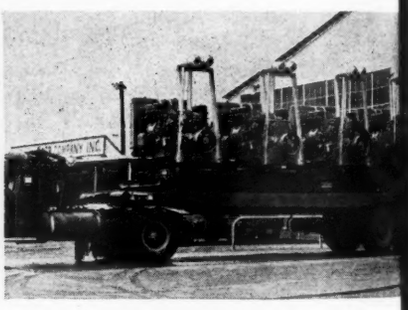
For Deepest Drilling

Brewster's "Golden Rig," the N-12 is powerful and rugged. . yet it's easy to move.

It has 8 drum speeds, 8 rotary speeds, two 850 h.p. pump drive sheaves and it is powered with four 400 horsepower engines.

After a year in the field the "Golden Rig" has proven the value of its "Extra Beef."

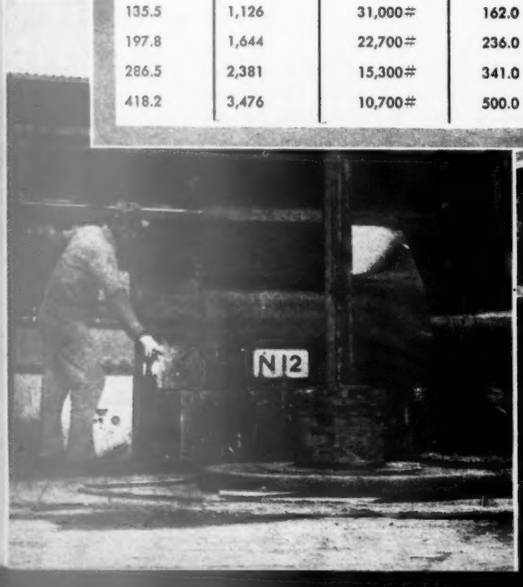


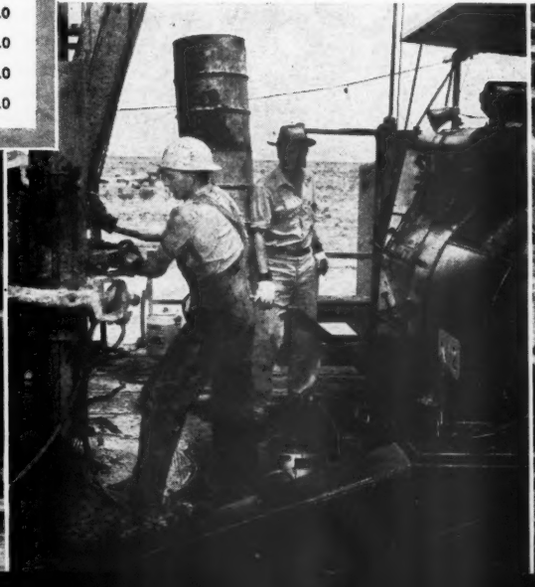


Drum Speed	Line Speed	Line Pull	Rotary Speed
34.4 RPM	285'/min.	126,000#	56.2
50.1	416	89,000#	83.5
72.6	603	59,000#	122.0
105.9	880	42,000#	177.0
135.5	1,126	31,000#	162.0
197.8	1,644	22,700#	236.0
286.5	2,381	15,300#	341.0
418.2	3,476	10,700#	500.0

The N-12 is easily moved. Penrod uses only standard transportation equipment for hauling the three major components of the rig from one location to another.

Penrod's "Golden Rig" in McElroy Ranch field, Texas, drilling its third deep well.





I Like the Extra Beef in Brewster's N-12"

Claude Roberson,
Drilling Superintendent
Penrod Drilling Company

"Our Brewster N-12 has drilled two deep tests and is on its third well. In its first year of operation we have found out that it has plenty of extra beef under that tough hide. That's why we haven't had to shut it down a single day for maintenance."

"BEST RIG I'VE EVER RUN"

J. D. Norris,
Tool Pusher
Penrod Drilling Company

"My N-12 has plenty of power to pull a long string out of the hole in a hurry and when it's drilling, there's no vibration, no matter how deep or how big the hole."

Write today for the new Brewster catalog, giving full details on Brewster drilling equipment.

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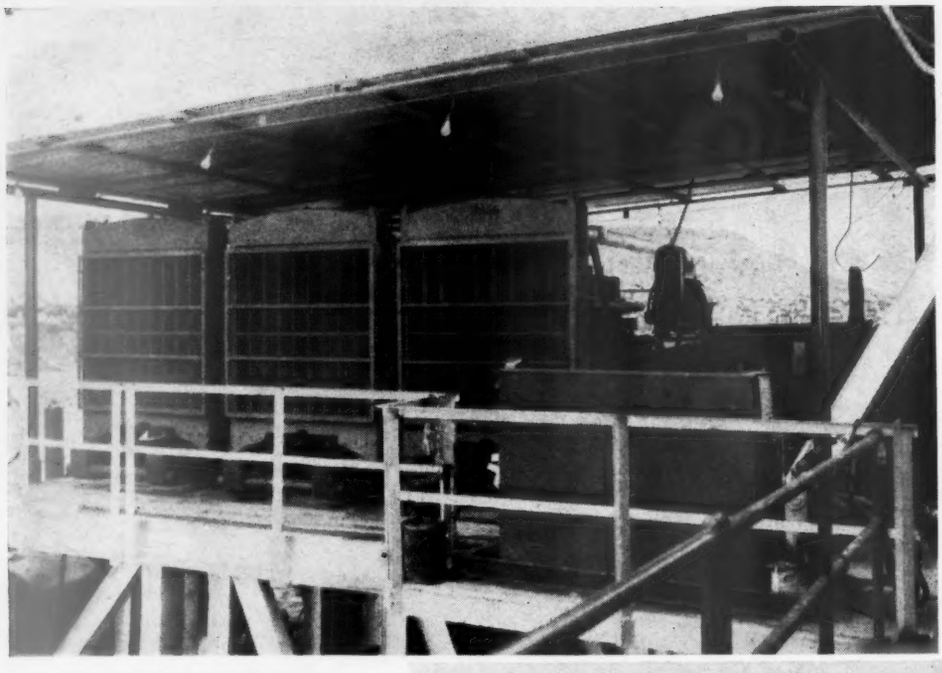
THE BREWSTER COMPANY, INC.
Shreveport, Louisiana

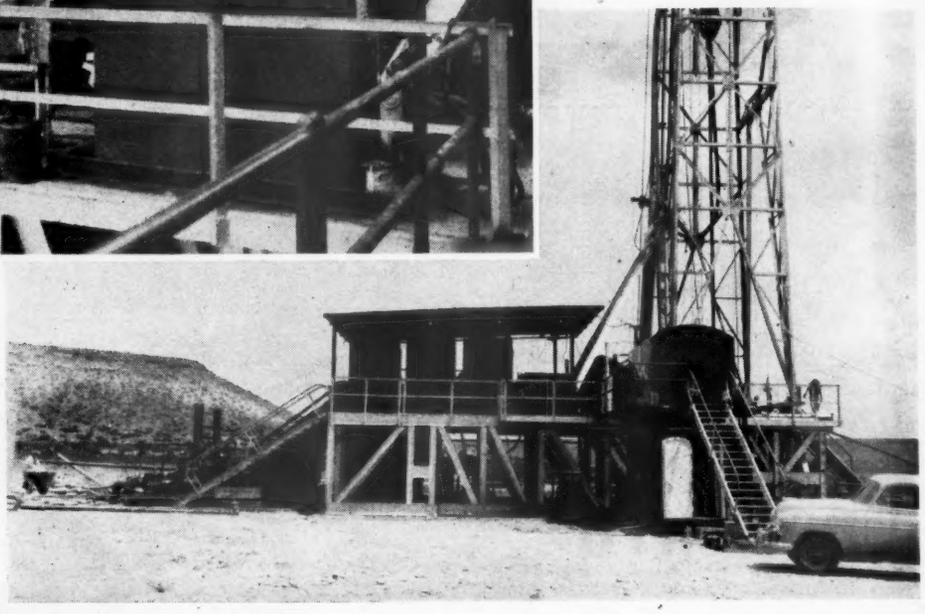
ANNIVERSARY OF BREWSTER'S GOLDEN RIG

Brewster rang up the curtain in July, 1950, on their new "Golden Rig," the N-12 drawworks for deepest drilling. In this advertisement is a first hand report from the drilling superintendent and the man who has been operating the first "Golden Rig" for the past year.

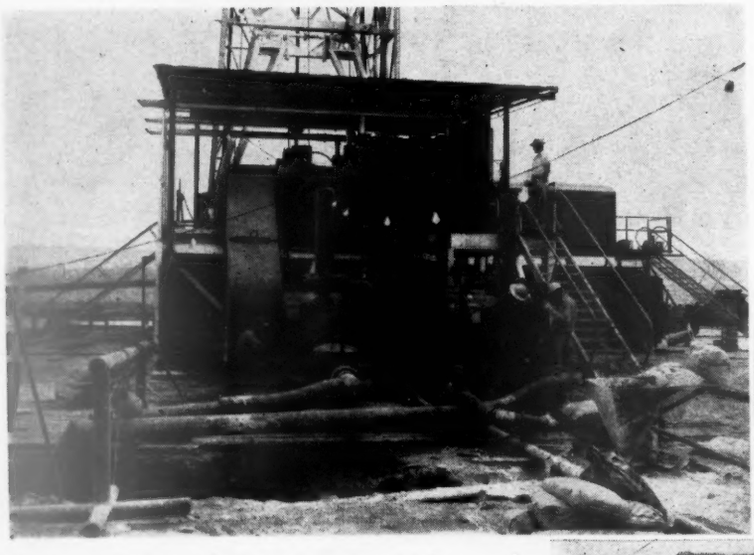
Since 1910 Manufacturers of fine Drilling Equipment



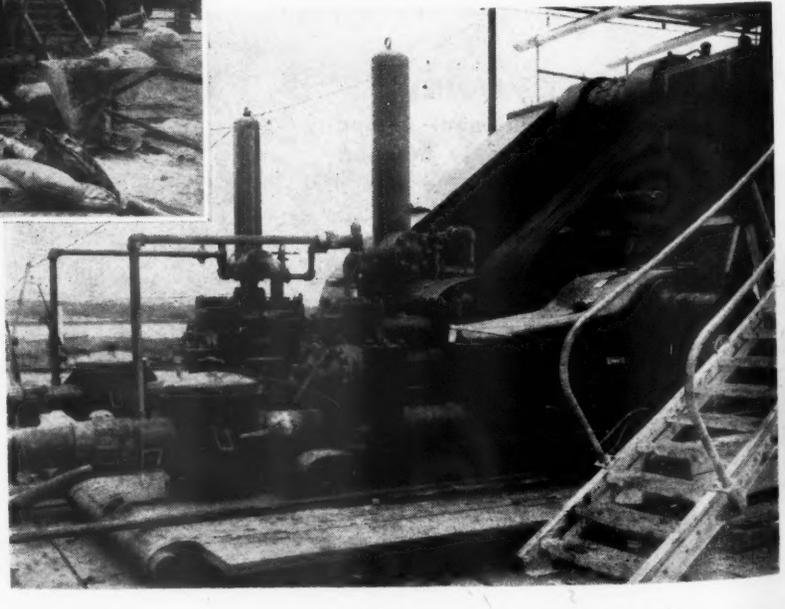
The portable 3-engine drilling rig rests on a unitized 10-ft high substructure, below. The main doghouse is supported by a similar doghouse used for lockers and supplies. A small skid-mounted engine-generating unit (at left of lower doghouse) is connected to the rig electrical system for emergency service.



The three engines, above, are mounted on individual steel skids, so that they can be easily slipped in or out of engagement with the power-take-off clutches mounted on the compounding transmission case. They rest on the two main skids and can be moved with the whole drilling unit where road weight limits permit.



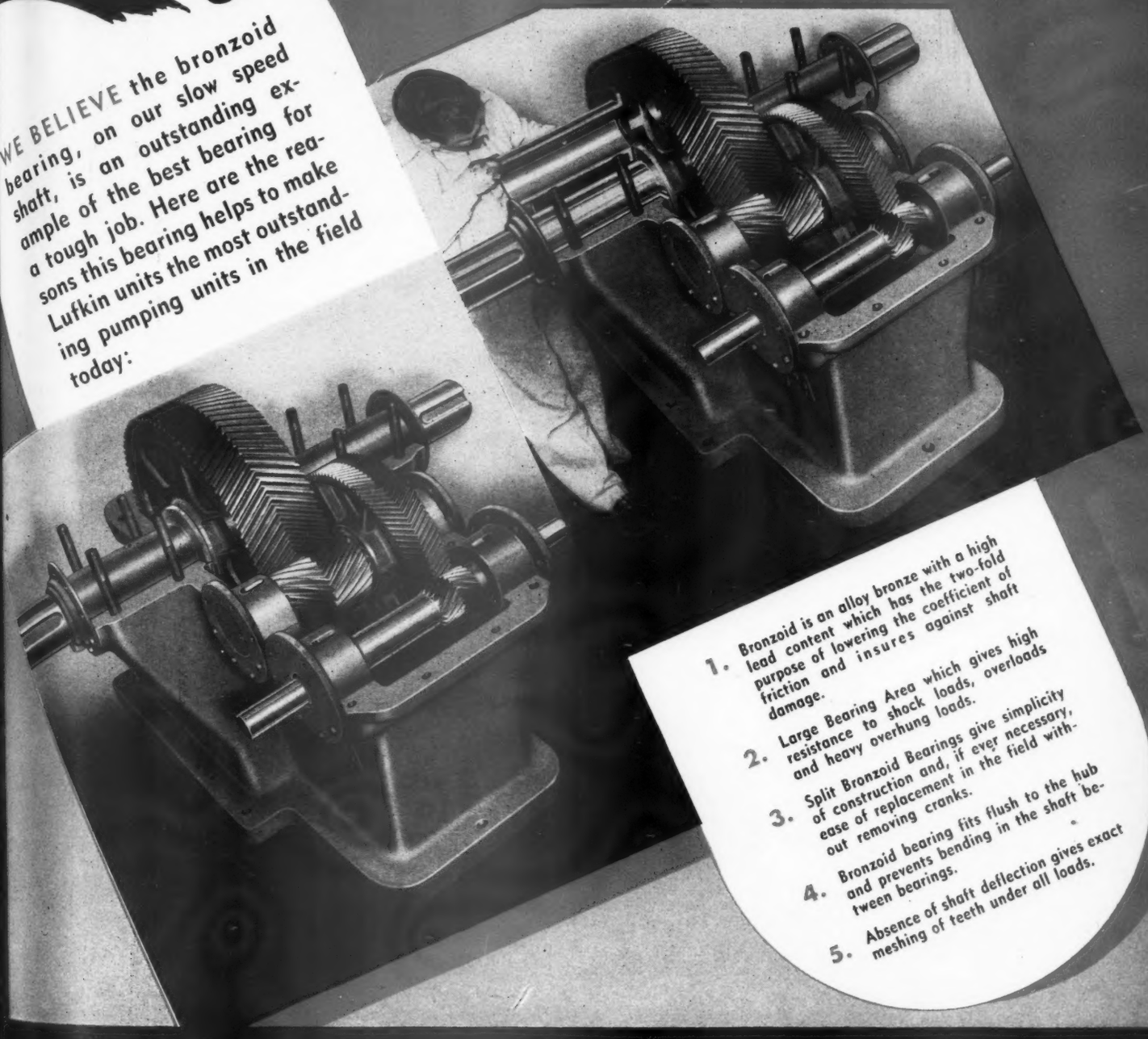
The skid-mounted mud pumps are operated by identical v-belt drives from outboard sheaves at the end of the main skids of the drilling unit. Manifolding is simplified by the "in-line" arrangement of the pumps. The suction lines are equipped with screens that can be removed easily for cleaning.



The mud pumps, above, are connected conveniently to the suction pit by large flexible hoses and intakes that can be raised or lowered with changes in the level of the mud. Dry mud and chemicals (in paper sacks at right) are added to the mud in the suction pit through the funnel-shaped hopper.

Lufkin USES ONLY THE BEST In BEARINGS

WE BELIEVE the bronzoid bearing, on our slow speed shaft, is an outstanding example of the best bearing for a tough job. Here are the reasons this bearing helps to make Lufkin units the most outstanding pumping units in the field today:



1. Bronzoid is an alloy bronze with a high lead content which has the purpose of lowering the coefficient of friction and insures against shaft damage.
2. Large Bearing Area which gives high resistance to shock loads, overloads and heavy overhung loads.
3. Split Bronzoid Bearings give simplicity of construction and, if ever necessary, ease of replacement in the field without removing cranks.
4. Bronzoid bearing fits flush to the hub and prevents bending in the shaft between bearings.
5. Absence of shaft deflection gives exact meshing of teeth under all loads.

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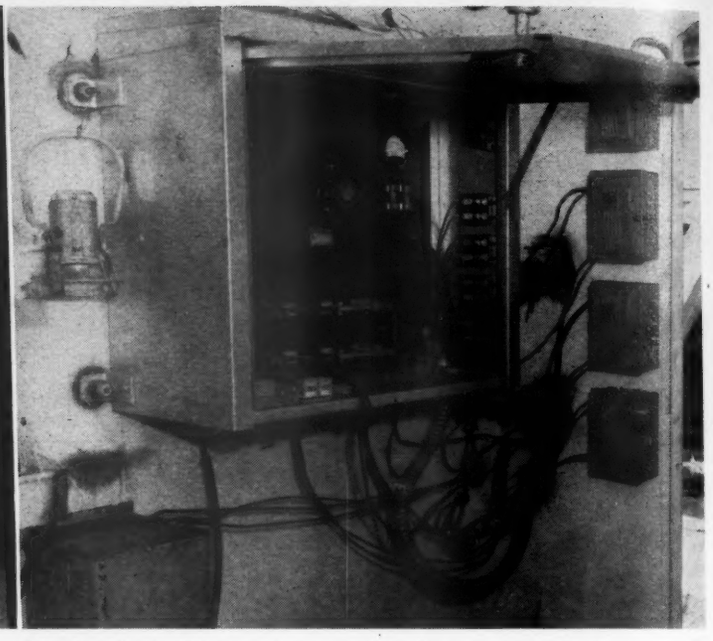
The washdown and water supply pump for the rig is mounted in the substructure under the engines. It is operated by v-belts from a pulley on the compounding transmission case above.



All electrical wiring systems on the rig are controlled in this central switch and fuse box mounted inside the main doghouse doorway. The emergency light plant is also wired through this control panel.

It is not necessary to break chains, disconnect air lines or oil lines when rigging up or tearing down. This is true even though the engines have to be moved separately to meet road requirements in certain areas. The engines can be removed or installed in the power take-off clutches[4] with ease.

Although the rig is narrow enough to make it easy to handle on the road and easy to install on portable derricks, the drawworks drum and auxiliary equipment is large enough to handle the necessary wire line and perform the work required.

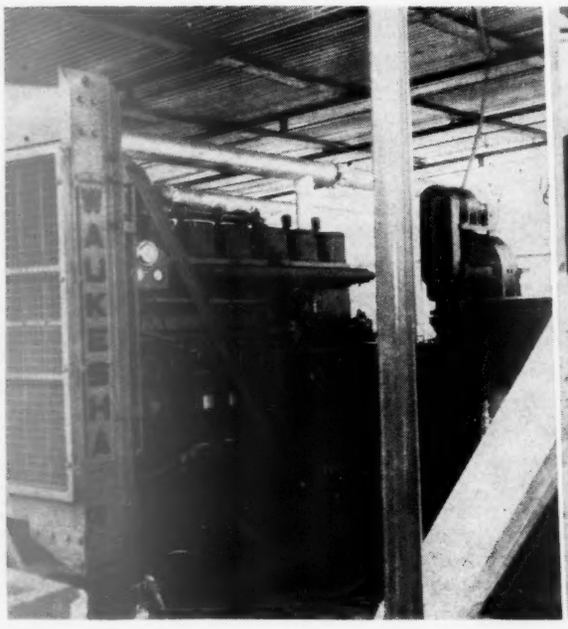
All valve controls[5] and heavy duty gages[6] are situated in a console mounted in front of the drawworks at the driller's position. The main brakes are 46-in. in diameter, the "full-wrap" type, having a 350 deg arc of contact with a 54 to 1 mechanical linkage ratio.

[4]Manufactured by Fawick Airflex Company, Inc., Cleveland, Ohio.

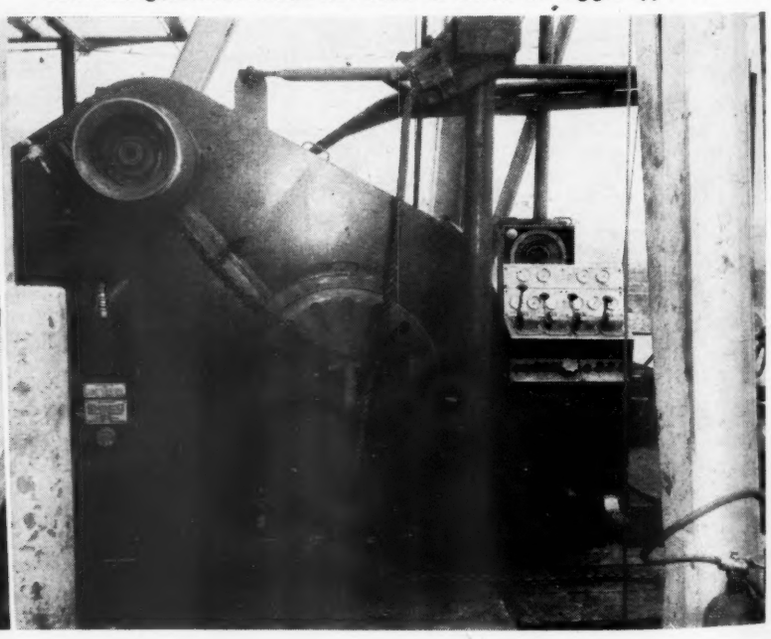
[5]Manufactured by Westinghouse and Valvair.

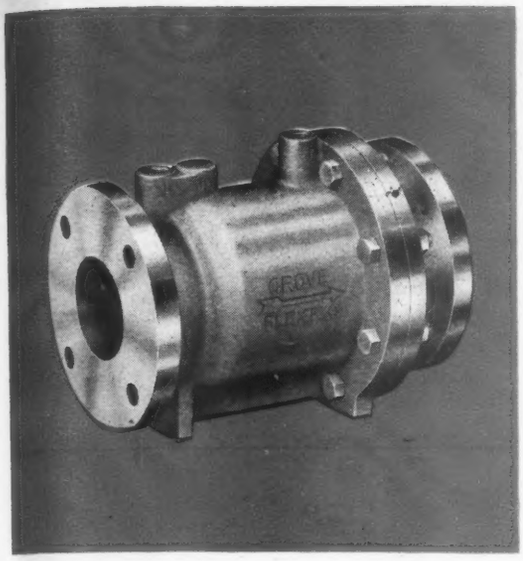
[6]Manufactured by Marsh Instrument Company, Skokie, Illinois.

The No. 1 engine at the left is mounted as a unit on its own pair of steel skids. The engines may be operated on either natural gas or butane. The main 15-kw generator is mounted on the compounding transmission case behind the No. 1 engine.



View from the doorway of the main doghouse shows the spinning cathead (upper left), the outside-mounted drawworks friction clutch (center), the driller's console control cabinet, and the drilling weight indicator (right). Note the gage faces, four toggle-type air-control valves, and the recessed panel containing control knobs not used as often as toggle-type controls.





Far simpler operation and maintenance with versatile Flexflo Valves

FLEXFLO Valves are basically diaphragm-operated, using an expansible tube as both diaphragm and valve. With only four simple parts including but one non-metallic moving part, Flexflos assure long, trouble-free service with minimum attention. Field replacement of the simple tube-core assembly affords new valve performance in a matter of minutes. Depending upon the operating system used, positive-acting Flexflos give highly efficient service as:

BACK PRESSURE REGULATORS
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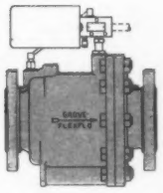
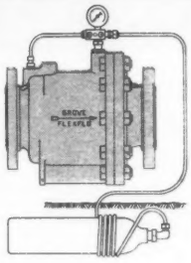
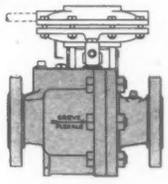
. . . and many other applications.



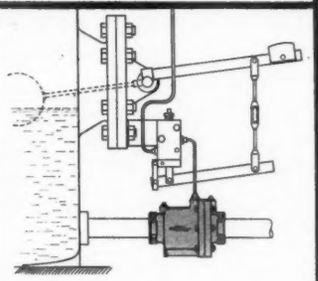
Model 80-41F. Solenoid-operated Flexflo for on-off service.



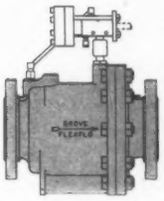
Model 888. Flexflo Dome Pressure Loaded Reliever for back pressure or relief service.



Model 898. High pressure Separator Oil Dump Valve for operation from level pilot.

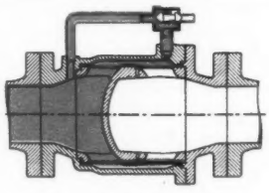


Model 80-899. Separator Oil Dump Valve for operation from float lever.



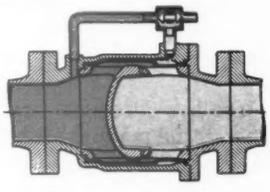
Model 80-42F. Pressure-operated Flexflo for on-off service.

flexflo lets pressure do the work:



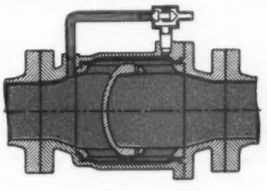
CLOSED

1 The only moving part in the Flexflo Valve is a tough Buna N tube stretched over a cylindrical slotted metal core. When closed, line pressure from within, tending to force tube off core, is opposed by equal jacket pressure. Tension of the tube itself forms a positive, bubble-tight seal. The tube conforms to uneven surfaces and is hence unaffected by foreign matter or erosive wear.



THROTTLING

2 As jacket pressure is reduced, line pressure begins to roll the tube off the core, opening the valve. Throttling is smooth and even. The Flexflo reacts instantly to the slightest pressure variations, compensating automatically for surge or shock impulses. Stability at all flow positions is accurately maintained. Fluttering and chattering are reduced to a minimum.



OPEN

3 When all jacket pressure is removed, the tube is forced completely off the core and the valve assumes its wide open position. Full flow capacity with minimum pressure drop is assured. As Flexflo employs no hinge-pins, guides or other metallic moving parts, no troublesome problems of corrosion or wear are encountered. It cannot stick, wedge or slam.

GROVE

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A routine check of the revolutions per minute of the main 15-kw generator, right, at rig idling speed is being made by a field service engineer. The friction clutches on the drawworks and compound transmission are mounted outside the oil-bath cases that house the chains and working parts.

The drilling mud returns to the pits, left, through the electric-motor-operated shale shaker at left, and is agitated by the high-pressure let-type mud gun at right, as it circulates around to the suction pit behind the pumps.

The mud pump manifolding is simplified by the "in-line" installation of the mud pump drives and the mud pumps. The mud pump drive shafts are divided, so that the pumps may be operated separately.

Other items of equipment in use with the new rig include: (1) A 131-ft bulge-type portable derrick[3] with a 537,000 lb load rating, (2) a new blowout preventer assembly[7], (3) spinning and breakout catheads,[8] (4) a 15-kw generator[10], (5) a central electrical control and switchbox[10], (6) a washdown water pump[9], and (7) a pre-fabricated double-deck steel doghouse[8].

Drawworks Design

The drawworks has six forward and two reverse speeds through friction clutches at the drum shaft. The drum high drive clutch is located at the rotary end of the line shaft, and the drum low drive friction clutch is located at the end of the drum shaft on the driller's side. The drawworks has four shafts and a rotary countershaft situated between the drum and line shafts.

There are five sprockets on the line shaft between the main shaft bearings, and four of these are mounted on bearings. There are two double-acting jaw clutches. Each of these is located between a pair of these sprockets, which are the three forward and one reverse driven sprockets of the line shaft. The fifth sprocket drives forward to the rotary countershaft, which is located between the line and the drum shafts. The rotary drive friction clutch is located on the outboard end of the countershaft. There is a drive from the rotary countershaft to the rotary idler, which is mounted on the end of the drum shaft. The rotary table has three forward and one reverse friction clutch drives.

A double sprocket is mounted on a bearing on the driller's side of the line shaft, which may be clutched in or out through the operation of a jaw clutch. One of these sprockets is the drum low drive, and the other sprocket is the catshaft drive. The drive to the catshaft may be disengaged by sliding out the jaw clutch during long periods of rotating the drill pipe. The drum high friction clutch is mounted on the rotary side end of the line shaft.

A free-spooling, friction clutch-driven sand reel may be mounted in place of the catshaft. Both the catshaft and sand reel shaft have their extensions machined in accordance with API Standard No. 7-A, Size No. 1, to receive the standard makes of catheads.

Four sprockets are keyed to the jack shaft between its main bearings, which drive forward to the line shaft. The neutral brake is located on the outside of the bearing on the driller's side. The master friction clutch is situated on the rotary side extension of the jack shaft. All of the friction clutches in the drawworks are mounted on the outboard ends of the shafts to facilitate servicing.

Compounding Transmission

The compounding transmission is built for operation with either two or three engines and with either one or two mud pump drives. The mud pump drives are situated at the rear end of the transmission in line with each other. The pump drive sheaves are pedestal-mounted and driven by fric-

[7]A "VHR" assembly by Cameron Iron Works, Inc., Houston, Texas.
[8]Manufactured by American Iron and Machine Works Company, Oklahoma City, Oklahoma.
[9]Manufactured by Gardner-Denver Company, Quincy, Illinois.
[10]Manufactured by General Electric Company, Schenectady, New York.

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tion clutches. High capacity, heavy duty chains are employed in the transmission.

The transmissions are designed so that in a three-engine, two-pump transmission, No. 1 engine may be used to drive the rotary table through the drawworks; Nos. 2 and 3 engines may be used, separately, to drive their respective pumps at different speeds, or may be compounded to drive either or both pumps. Several other power flow combinations are possible with a three-engine, two-pump drive transmission. The engines are connected to the transmission through pneumatically-controlled clutches.[4]

Controls

All the controls are located at the driller's position, with the exception of the controls of the compounding transmission. The toggle-type valve controls are mounted in a console-type cabinet in front of the driller. The pressure gages for lubricating oil, brake rim cooling water, air supply tank, drum clutches, rotary clutch, master clutch, and engine and pump clutches are mounted on the top row of the console panel. Either vacuum gages or a multi-point exhaust type pyrometer may be supplied, depending on the type of engines used.

The main control valves are directly below the gages. The first valve on the left is for the drum high speed and low speed friction clutches. Next, is the valve for the master clutch and neutral brake. The third valve operates the rotary clutch, and the fourth valve operates the two catheads.

Control valves that are used less frequently are mounted in a recess directly below the main valves. These include: 1. the mud pump clutch valves; 2. the engine power-take-off clutch valves; 3. the hand throttle valves, and 4. the selective transmission push-botton control valves. All these valves and gages are mounted on the console, except the foot throttle valve, which is interconnected with the hand throttle valves. The entire back of the console cabinet is hinged to give free access to the valves and connections. Both sides of the unions on the hose "jumper" connections are marked with numbers, so that the console may be removed easily by uncoupling the connections.

The selective transmission controls are of the positioner type. The jaw clutches are engaged, disengaged, and positioned by positive movements caused by air pressure. The actuating cylinders are located directly back of the drawworks between the drilling motor and the jack shaft. They are accessible by removing a cover held in place by two cap screws.

An air filter and an automatic dump valve to free the main supply line of air system of dirt and moisture are mounted in the console cabinet.

The sand reel brakes are of the spring-applied, air-released type. One valve operates both the brake mechanism and the sand reel friction clutch.

Air Compressors

The two-stage air compressors, mounted on the compounding transmission, are driven from the rotary side extension of the engine shafts.

The oil pumps are mounted on the compounding transmission, and are driven from the engine shafts. These pumps circulate lubricating oil through all bearings and chains. A large capacity oil strainer, mounted on the suction line of the oil pumps, is situated on the outside, where it may be cleaned very easily. All bearings, chains, and working parts are lubricated by oil pressure, except the two bearings on the sand reel spool and the pillow blocks of the mud pump sheaves.

The drawworks frame and the compounding transmission case are designed and constructed to support the various shaft assemblies. They are machined accurately for bearing and shaft alignment. The side walls serve as oil bath enclosures for all drives and working parts. * * *

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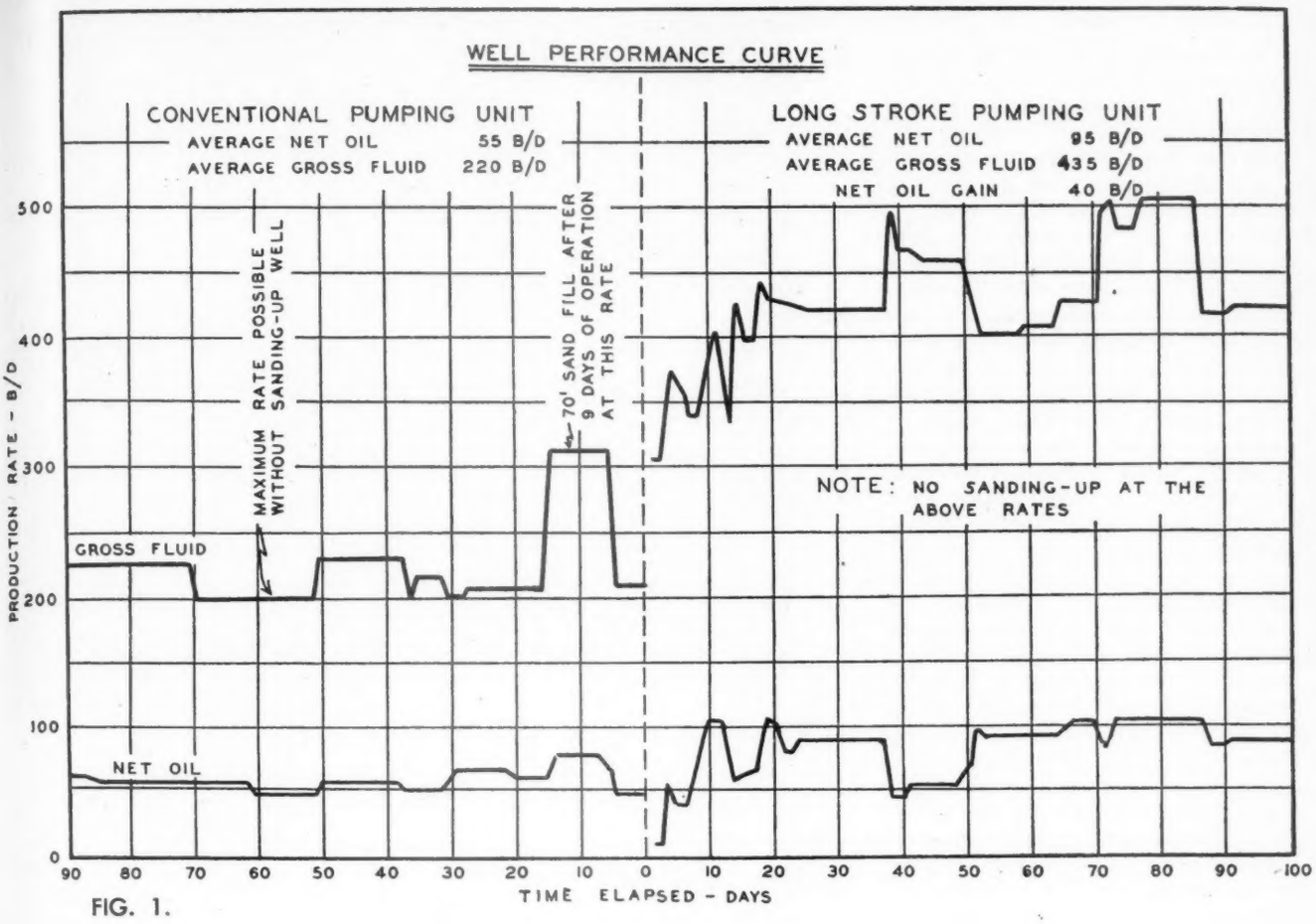
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NET OIL
PRODUCTION RATE - B/D
TIME ELAPSED - DAYS

FIG. 1.

Design of Oil Well Pumps

Some designs made to cope with existing problems in a particular field have proved effective in overcoming some of the difficulties

MARSHALL C. TURNER*

THE pumping of clean medium gravity oil from average depths offers little problem in pump design. Innumerable data are available that give the correct bore size, fit, stroke length, etc., needed to obtain the desired production. One has the choice of liner (RLA) versus tube (RWA) type pump, bottom lock versus top lock, etc.; but the pump design will be essentially the same. Under such ideal circumstances pumps give little trouble, and the frequency of pump failures is not severe enough to represent a major operating cost item.

It is often necessary, however, to provide a pump to operate under well conditions unfavorable to pump efficiencies and pump life. Some of these conditions cause pump failures that, in turn, necessitate well-pulling and pump repairs. The frequency of such failures becomes a prime cost factor in the field's operating expense. Some of the common characteristics affecting pumping may be classified as:

1. Sand entrained in the oil.
2. "Low-gravity" crude.
3. Scale deposition in the pump.
4. Gas entrained in the oil.
5. Corrosion.

Where these conditions are encountered, it is usually found that pump designs have been modified in attempts to cope with the existing problems. The operator of a field, after considerable experimentation, may arrive at the type of pump best suited to handle his production. Although each one of the above adverse conditions could bring out considerable discussion, this article will describe variations in pump designs that have been tried in the field and have proved effective in overcoming some of the difficulties resulting from these conditions. They are not presented as sure cures, but it is believed that the information will be useful as a guide in the choice of a pump for a particular problem.

*Continental Consolidated Corporation, Long Beach, California.

EXCLUSIVE

Sand

The production of sand-cut oil presents a major problem in many fields, and in some areas the inability to cope with sand has rendered uneconomical wells that could otherwise be operated at a profit. In discussing the effect of sand on oil well pumps, the result of sand entry into the pump bore may be classified as having two general effects: (1) sand may enter the pump in sudden large concentrations, thus completely clogging the moving parts and stopping pump action, or (2) sand may be carried in the oil in a fairly constant percentage, which, if pump action can be maintained, will gradually wear the moving parts until the pump can no longer hold a seal. In either case there exists the danger that once pump operation ceases, additional sand entrained in the oil in the tubing has time to settle on top of the pump. In severe cases so much sand will accumulate that the pump cannot be unseated and it becomes necessary to pull rods and tubing "wet", thus considerably increasing the cost of pulling operations.

Little can be done with the first condition by modification of the pump itself. One may reduce the chances of sudden entry of sand in the well bore by increasing the back pressure against the formation, by depressing the fluid level slowly over a several-day period after starting to pump, or in some cases by injecting clean oil down the casing to reduce sand concentration in the fluid produced.

Where the second condition exists, it is essential to use hard steel alloys in the pump for maximum resistance against the abrasive effect of sand. It is of importance that once the sand enters the pump and tubing the fluid velocities be continuous and sufficient to carry the sand to the surface. A gas anchor with flow restrictions that will result in a higher fluid velocity than found in the tubing string will give trouble, since some of the larger particles may be carried through the pump and yet be unable to rise in the tubing. Likewise a gas anchor with a closed bottom can accumulate sand until a sand level close to the pump intake is reached. At this point a restriction is formed and the accelerated fluid velocity will carry into the pump larger sand particles that otherwise would settle in the well. In effect, if other well characteristics permit, it is usually best to use no gas anchor at all in sandy wells.

In keeping with this practice of maintaining higher fluid velocities in the production string of sandy wells, one would attempt to make the pump bore as small as possible and yet allow for the desired production. Many attempts to put this theory into practice,

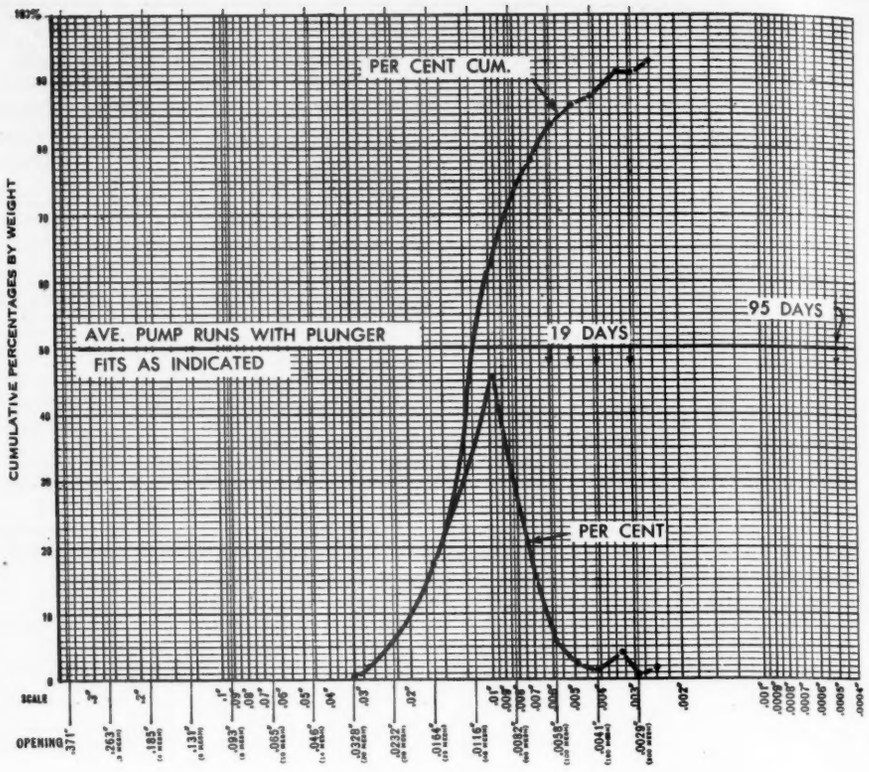

FIG. 2.

however, indicate that the reverse is desirable. The writer has had greater success in producing sandy oil with larger bore pumps and slower pumping speed. Perhaps the resultant slower pumping speed for the same displacement has some merit. It is thought by many production men that the slower stroke is of especial advantage in the control of sand, the contention being that in conventional pumping installations the more frequent opening and closing of the standing valve causes pulsations on the well bore that tend to dislodge the sand particles. Some experiences tend to support this theory. An outstanding example is Fig. 1, which shows an actual performance curve for a well before and after the installation of a 10-ft stroke pumping unit.

To promote longer pump life in sandy wells, the writer has made attempts to arive at some optimum relationship between a pump's initial plunger fit and the particle size distribution of the sand present in the well. Fig. 2 shows the result of screen analysis on sand from a well that gave considerable pump trouble. Pumps in this well had an average life of 19 days, the longest run obtained during an 8-months' period being 38 days. Longer pump life had been attempted by variations in bore sizes, plunger fits, and different alloy pumps. During a bailing operation sand samples were taken for analysis and the results plotted as illustrated. A pump was purchased with a 24 in. plunger having at each end a ring of extremely hard alloy steel (tungsten carbide) ground to plunger size. The plunger was carefully fitted to a set of liners with a —.0005 fit, and the pump was made into a top lock RLA 2½ in. by 1¾ in. by 10 ft. On the initial run production was maintained for almost 4 months without interruption, and subsequent pump changes were required every 3 to 4 months.

Fig. 3 is a similar graph for a well producing 12 API gravity oil and giving sand trouble. As in the above example, little success had been obtained with pumps having initial plunger fits of —.003 in. to —.006 in. The average pump life was approximately 3 weeks. When fitted to initial fits of —.008 in. two pumps gave runs of 3 months each. After this 6-month period a trial with a pump of —.004 in. fit sanded up in a week. Return to the—.008 in. fits again gave long runs. The low gravity of the crude and the relatively shallow pump depth of 3500 ft permitted the use of —.008 in. fit.

In the first instance success with the tight fitting plunger may be attributed to the fact that close to 100 per cent of the sand particles were too large to enter the space between plunger and barrel, thus greatly reducing the initial abrasive action between the two. This pump design has been tried in numerous wells producing sandy oil, and a high degree of success has been obtained.

It is of interest that in the second example improved pump life with a

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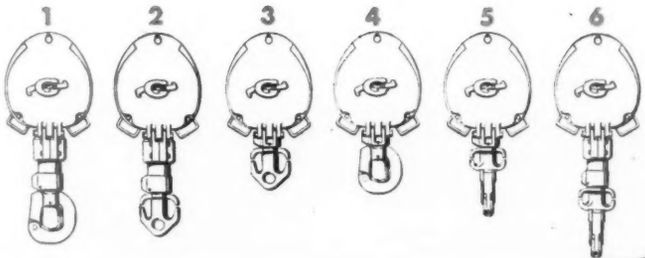

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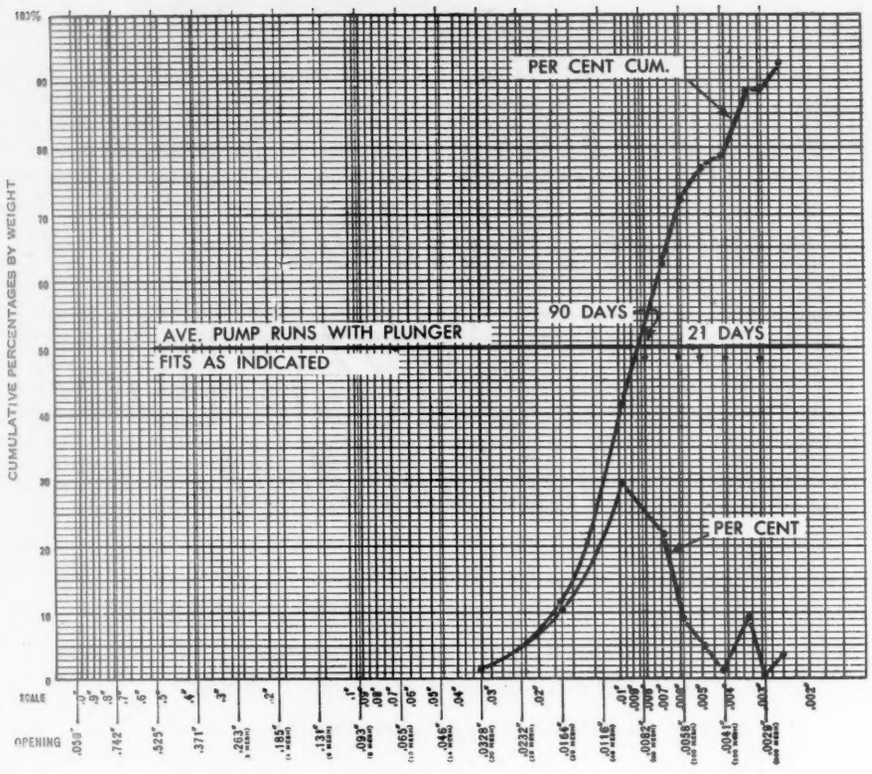


FIG. 3.

— .008 in. fit is very apparent, and yet it is difficult to correlate this success with sand grain size distribution. The reason for improvement is somewhat obscure. The use of plunger fits in the range of —.008 in. has of course limited application, and in wells with sand particles of the sizes illustrated it is not expected that the fit will remain —.008 in. very long. In fact, after the first successful run mentioned the clearance between the barrel and plunger in some portions amounted to as much as —.027 in. One may surmise that the initial wear was relatively rapid and that sand particles had a chance to slip past the plunger without causing sufficient friction to stick the plunger. Because of the high viscosity of the crude (over 1,000,000 seconds saybolt @ 60 F) the loose fit did not materially affect production.

Low Gravity Crude

Attempts to pump oil from wells in the low gravity range of from 6 to 10 or 12 deg API have brought many innovations in pumping string designs. In viscous crudes the pump plunger and rods tend to drop slowly, oil enters the pump bore at a relatively slow rate, and gas entrained in the oil is not readily liberated at the gas anchor. The pumping of low gravity oil has been effected by elaborate systems of bottom-hole diluent injection systems, hot water circulation systems, macaroni string combinations, etc. To keep within the scope of this article, however, the discussion will be limited to the pump itself. In any system that by heat or diluent in the well bore reduces the viscosity of a very low gravity crude to that comparable to a 14 or 16 deg API oil, the problem of pump design becomes minimized.

For the pumping of low gravity crudes the plunger fit should be as loose as is permissible for the pumping depth. In a California field producing 6 deg crude diluted to 11 deg at the pump shoe, an initial fit of —.006 in. is standard practice. The pump bore and the standing valve opening should be as large as possible. In the above field the standard pump is a 5 in. by 4½ in. by 16 ft RWA pump. Used for tubing with a specially constructed 5-in. top lock is 5-in. casing.

Of particular interest is a pump that was used successfully to pump 9 gravity oil without dilution. This pump is illustrated in the schematic drawing of Fig. 4*. It consists essentially of a top lock pump having two different sized bores. On the upstroke the standing valve opens and allows well fluid to enter the bore B. On the downstroke the standing valve closes, the traveling valve opens, and the fluid in B is forced through the plunger into the tubing above the pump. When the traveling valve is open the hydrostatic pressure of the fluid column in the tubing is effective both on top and bottom of the plunger area. In a conventional pump these forces neutralize one another. As the top of plunger A has a larger cross-sectional area than plunger B, however, the net effect on the downstroke is a force pushing the plunger downward. This force is essentially the weight of the column of fluid acting on the net area difference between plungers A and B. The lower portion of bore A is provided with openings and well fluid can surge in and out with each pump stroke.

This well has been equipped with a 3 in. by 2½ in. by 12 ft RWA pump, and above the speed of 5 strokes per minute the pumping unit carrier bar traveled downward faster than the polish rod would drop. With the above pump installed, a speed of 14 strokes per minute was obtained without slack occurring in the unit's bridle. This type of pump has been used successfully, not only on low gravity fields, but also in wells having a high polished rod load range, considerably reducing the difference between maximum and minimum loads.

*Manufactured by Fluid Pack Pump Company.

Scale

In wells where a scale condition exists, scale deposition will take place on the unswept portion of the pump bore. This deposition will accumulate until the plunger momentarily travels beyond its normal sweep. The scale layer may then wedge the plunger tight against the bore, thus stopping

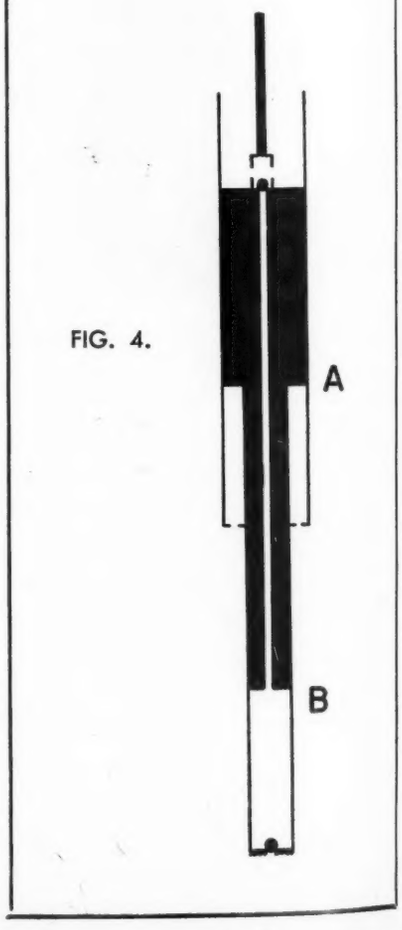
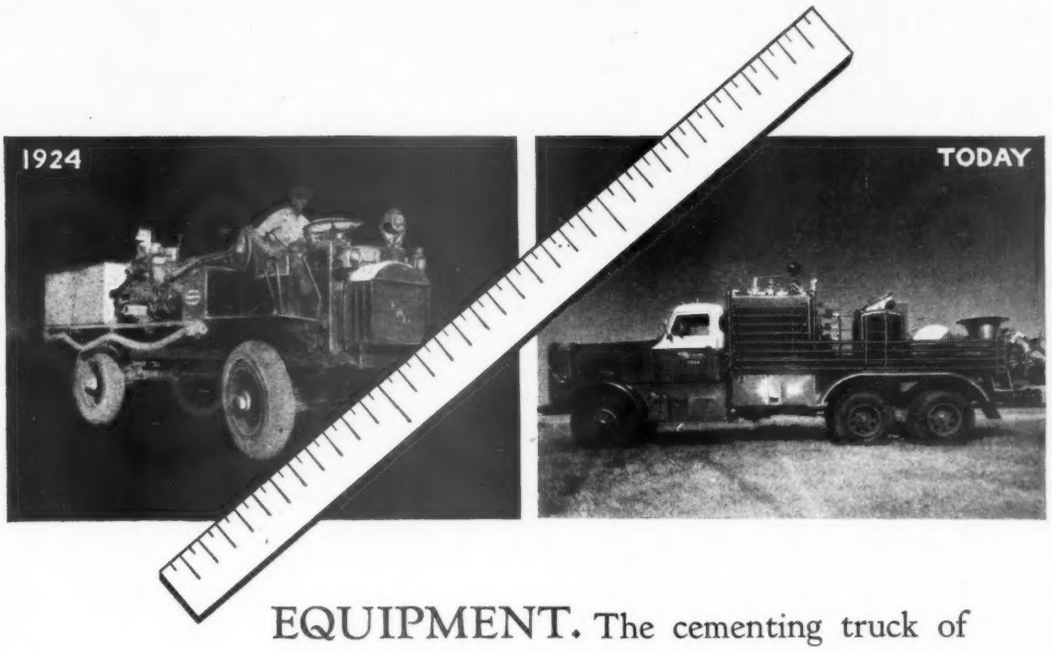


FIG. 4.

BY ANY YARDSTICK... CEMENTING PRICES ARE LOW



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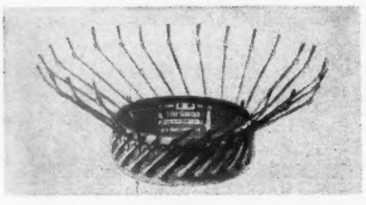

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pump action. If the fluid in the tubing is carrying sand, the stoppage of flow allows the sand particles to settle and accumulate on top of the pump, thus further impeding attempts to loosen the plunger from the surface. It is important to note that so-called sanded-up jobs may be in some instances primarily caused by scale deposition and could be remedied if the scale were combatted instead of the sand. Scale deposition usually accompanies a fair water cut, and where water is present in the oil, the above condition with respect to sand becomes more acute. If scale stops plunger action, water tends to wash the sand and settle it more rapidly.

The pump that has proved to be most successful for overcoming scale deposition, is one on which the plunger will sweep out of the pump bore at the top and bottom of each stroke, thereby preventing the scale layer from building up within the bore. For instance, a 2½ in. by 1¾ in. by 7 ft by 9 ft by 11 ft RLA pump has a finished bore of 7 ft with a 2 ft extension nipple between the pump bore and the standing valve and a similar 2 ft extension nipple between the bore and the top-lock assembly. With a 48 in. plunger and a 50 in. stroke, if properly spaced, the plunger should protrude out of the pump bore into the larger diameter extension nipples at top and bottom of each stroke. Also the ends of the plunger will be carried into the enlarged area at each stroke. Thus the entire area of fit in the pump will be swept, eliminating the build-up of scale on this critical area. Care must be taken not to have the plunger protrude from the top bore too great a distance in comparison to the plunger length, otherwise sideways lever action of the plunger may crack a liner.

There are some types of calcium scale that do not form a tight bind to metal surfaces, and when deposited in the pump or gas anchor, flakes may slough off and become temporarily lodged in one of the pump valves, thus stopping production. Where this exists, considerable improvement can be brought about by using 2 traveling valves and 2 standing valves. With this double valving it is less likely that both valves will be put out of commission at the same time.

Gas

Free gas in the pump bore readily decreases pump efficiency, as a portion of the plunger stroke must be used to expand and compress this gas before valve action is achieved.

The oil may be foamy in nature with gas entering the pump entrained in the oil. This is often true of low gravity wells where the high viscosity of the oil hinders gas separation in the well or at the gas anchor. If an oil is near the gas saturation point at the pump shoe, then the differential pressure across the standing valve will result in gas being liberated as the oil enters the pump.

With gas entrained in heavy oil, little can be done as a remedy except to use as large a bore as possible and accept the resulting low pump efficiency. Pumping conditions in other wells having high gas-oil ratios can be considerably improved by (1) using as large a standing valve as possible, and (2) minimizing the space in the pump between the traveling and standing valves when the plunger is at the bottom of the stroke. Dead space in the pump can be reduced by spacing the plunger as low as possible, by close coupling of the standing valve to the pump bore, and by installing the traveling valve cage assembly at the bottom of plunger instead of at the top.

Corrosion

The corrosion of pumps is a severe cost factor in many areas. In recent years new alloy pump parts have appeared that enable operators to obtain considerably longer runs than were possible a few years ago. However, it is believed that the problem of preventing corrosion in the pump is basically not one of pump design but rather prevention of the electro-chemical reactions that cause corrosion in the well bore. The technique of injecting inhibiting agents in the well, such as sodium chromate or organic inhibitors, has been used with a varying degree of success. The complete electrical insulation of well-heads at the surface has in some instances tended to reduce pump corrosion of the type resulting from electro-deposition. There has been extensive research on inhibitors and progress will continue to be made. The best that can be offered at present as an aid in the design of the pump itself is the use of special alloys in the pump parts.

Corrosion resistant steel has greatly improved pump life. Where chrome is used it has become apparent that longer wear can be obtained if the chrome is plated on corrosion resistant steel rather than on the usual hard cast metal. Chrome being porous, the corrosive elements have access to the plated metal and readily destroy the bond between the chrome and plated surface. Tungsten carbide steel is an excellent alloy for such fittings as balls and seats. Using a longer plunger and bore than normally used tends to increase pump life under corrosive conditions. It should be remembered that in a pump the stationary parts are not affected as much by corrosion as the moving parts, and therefore it is often only necessary to provide special alloys for these moving parts.

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Producing fluid from wells by modern gas-lift standards involves determining the efficiency factors and the use of special valves

C. D. FLETCHER* and M. M. LIVINGSTON*

GAS lifting by continuous flow is defined, from an operational standpoint, as the aeration of a fluid column, by continuous gas injection, thereby lowering the flowing gradient of the column to a point where the total weight of the fluid column from the point of injection to the surface is less than the flowing bottom hole pressure at the point of injection. This permits bottom hole pressure energy and the result of a fluid column lengthened by aeration, to deliver fluid to the surface. Within the past few years rapid advancement has been made in equipment development and the practice of producing fluid from wells by this method.

Improved Operation and Control

Before continuous flow equipment and practice was developed, wells of high fluid level and high productivity were generally produced with automatic differential valves or jet collars. When differential valves were used, control of gas passage was difficult and erratic. If many valves were used in a string, the upper valves would automatically open during operation generally causing unsatisfactory results. When jet collars were positioned correctly, in wells of exceptionally high productivity, they were very efficient but if the well characteristics changed, they became inefficient. Changing position of the injection point to meet well conditions required handling of the tubing.

With continuous flow equipment, operation is based on casing annulus pressure and volume. A sensitive control can be maintained over these factors from the surface. When a well is correctly classified in a continuous flow category and the valve string is correctly designed, this type operation will provide exceptionally efficient results. The top valves in the string can be definitely closed and will remain so unless needed. This assures injection of gas at the lowest possible point. The control of casing annulus pressure and input gas volume provides a range of adjustment to give a minimum gas-fluid ratio and maximum fluid production.

Minimum and Maximum Fluid Production

The total amount of fluid to be produced daily by this type operation is a major efficiency factor, therefore, the operation is limited to wells with certain distinct characteristics. Wells should have a high fluid level and high productivity from a limited depth in order to operate most efficiently with this method.

It is very difficult to establish a minimum fluid production figure because of the many factors involved. Depth of operation, available pressure, fluid viscosity, and size of eductor tube are all of major importance. Under average conditions, however, it is possible to establish a broad rule by which wells might be classified as being in the continuous flow category. With 2 in. tubing a minimum of 300 bbl total fluid per day might be efficiently produced. With 2½ in. tubing a minimum of 500 bbl and with 3 in. tubing a minimum of 750 bbl.

Generally speaking, quantities under these minimum figures should be produced by intermittent flow. There is, of course, an overlap between the minimum quantity under continuous flow and the maximum quantity under intermittent flow. Where such condition exists, an analysis of local conditions or the operator's preference generally governs the choice of operation selected.

The maximum possible fluid production is determined by the ability of the well to produce or the capacity of the eductor tube. When producing through 2 in. tubing, a maximum of 1000 to 1200 bbl per day might be expected. Through 2½ in. tubing a maximum of 2200 to 3000 bbl per day is possible. Quantities in excess of 3000 bbl should be produced through larger tubing or by casing flow operation. The estimated maximum production figures above are based on dead lift operations. Where a well has considerable reservoir energy, the possible maximum production may be greater.

Maximum Operating Depth

The maximum operating depth of an aerating type of flow is a function of available operating pressure and minimum efficient flowing gradient that can be established and maintained in the fluid column. In order to understand this depth limitation, it is necessary that the principle of the method be understood.

Assume a vertical column of fluid 4000 ft high with an average gradient of .44 psi per foot of height. The column would exert a pressure of 4000 by .44 or 1760 psi at its base. If sufficient gas were injected and the column aerated to a point where the average gradient was .20 psi per foot of height, the pressure at the base would be 4000 by .20 or 800 psi. If the average gradient were .10 psi per foot of height, the pressure at the base would be 4000 by .10 or 400 psi.

If an attempt were made to inject gas at the base point in either of the above examples, a pressure in excess of the fluid column base pressure would be required.

The maximum operating depth of this type flow under the existing surface conditions may be expressed in formula as follows:

$$D = \frac{P - Pt}{G}$$

Where:

D — maximum operating depth in feet from surface,
P — surface operating pressure of valve—psi,
Pt — flowing tubing pressure—psi,
G — average flowing fluid gradient —psi/ft.

This formula is an approximation, as the gradient changes with distance from the surface and the weight of the casing gas column is not considered.

Excessive Operating Pressure

A factor to consider in any aeration type of flow is the result of excessive operating pressure. When higher pressures are used in an attempt to work lower in the hole, admission of additional gas lowers the flowing gradient

*Merla Tool Company, Dallas, Texas.

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of the tubing fluid column beyond a point of efficiency.

When this exists, a reduction in quantity of fluid lifted occurs because friction loss in the tubing creates back pressure to the extent that the flowing bottom hole pressure is raised instead of lowered. This tends to reduce the differential between reservoir pressure and flowing bottom hole pressure, thereby reducing the quantity of fluid flowing into the well bore.

Valve Construction

The basic construction of a continuous flow gas lift valve is that of a spring loaded back pressure valve, (Fig. 1). The assembly consists of a three-ply seamless monel bellows enclosed in a bellows guide. This bellows is filled and hermetically sealed, at atmospheric pressure and temperature, with a special fluid having an exceptionally high boiling point. Compressed when filled, its elongation to static working length leaves a void space inside the bellows. The fluid restricts travel in operation to protect it from rupture or distortion when subjected to high hydrostatic pressures. The void space inside the bellows also provides for fluid expansion under the highest possible operating temperatures.

A valve stem, attached to the bellows, extends through the bottom of the bellows guide. A compression spring, solidly seated in the bottom of the bellows guide, is guided to the stem by a guide nut at the bottom of the spring. The guide nut is locked into position with a lock nut. The compression spring is scientifically constructed to maintain the set operating pressure of the valve without overcoming the elastic limits of the spring metal. A tungsten carbide ball valve is locked into position on the bottom of the stem.

The valve seat assembly consists of an adapter in which a removable tungsten carbide valve seat is installed. Valve housing is perforated to permit entry of annulus gas. A housing cap completes the assembly. Adapters for installation of back checks and chokes are available, if desired.

Valve Operation

The predetermined operating pressure of the valve is set by spring tension. This feature makes the valve a throttling type valve, a necessary requirement in continuous flow type operations.

After the valve has been opened, the greater the pressure against it the farther the valve will move off the valve seat, because the spring will compress directly in proportion to the force applied against it. This feature permits control of gas passage through the valve merely by regulating the amount of gas pressure in the operating annulus. With this type control, chokes in the valves are unnecessary.

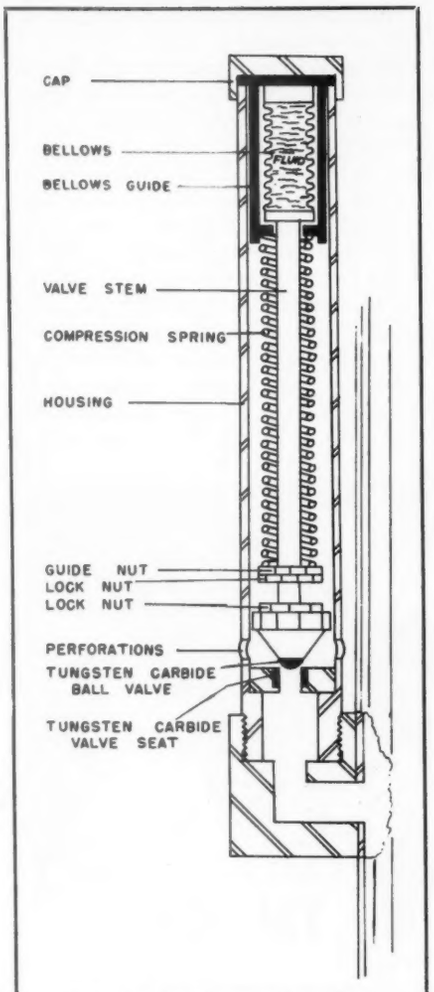

FIG. 1. Continuous flow gas lift valve.

Where large quantities of salt water are produced by continuous flow methods, high temperatures are usually encountered. These temperatures may vary from 60 to 300 deg according to the individual well. If a valve is sensitive to temperature changes its operating pressure might be varied to where it would stymie the operation of the entire valve string. Be sure the valve selected for this type work has a minimum temperature effect.

With the large volume gas passage generally required with this valve, it is imperative that the valve and valve seat be of special hardened material, usually of the tungsten-carbide class.

Closing Pressure Operation

In order to determine accurately the minimum closing pressure of a valve, the test block operation must simulate, as nearly as possible, the actual conditions under which the valve will operate in a well.

If a valve is placed in a test block and pressure applied to the upstream side of the valve only, the gage reading when the valve opens will record the maximum opening pressure of the valve; that is, the opening pressure with no back pressure against it. Close the downstream side of the valve in the test block with a needle valve and open the valve in the test block. Raise the pressure in the block until the gage reading is in excess of the maximum opening pressure of the valve. Close the inlet line to the test block and bleed off the pressure on the downstream side of the valve with the needle valve at a very slow rate.

When the pressure reaches a point where the closing forces of the valve are equal to the opening forces, the valve will close. The pressure gage on the upstream side of the valve will then record the minimum closing pressure of the valve. This minimum closing pressure is the pressure used in calculating the valve spacings.

Principle of Valve Operation

There are, of course, two forces involved in the actuation of the valve, opening forces and closing forces.

The bellows in the valve acts as a piston, or diaphragm, across which pressure is applied to obtain opening force. The opening force, therefore, is the result of operating pressure upon the cross-sectional area of the valve seat plus the result of back pressure upon the cross-sectional area of the valve seat.

The only closing force is spring tension. This force is the spring tension required to overcome the effects of operating pressure across the net cross-sectional area of the bellows and valve seat. The pressure overcome by the force of the spring tension is the minimum closing pressure of the valve.

Expressing the forces involved in the valve actuation in formula, with the opening forces on the left side of the equation and the closing force on the right side of the equation, it would read:

$$OP(BA - SA) + (BP \times SA) = ST$$

Where:

OP — Operating pressure, psi
BA — Cross-sectional area of bellows in sq in
SA — Cross-sectional area of valve seat in sq in
BP — Tubing or back pressure, psi
ST — Spring tension.

For example, with a valve having a minimum closing pressure of 550 lb, a bellows cross-sectional area of .30 sq in., and a valve seat cross-sectional area of .05 sq in., the spring tension required to close the valve would be:

$550\ (.30 - .05) + (550 \times .05) = 165$ lb

With the opening forces of the equation greater than the closing force, the valve is open and will remain so as long as the condition exists. When the forces are in equilibrium or the closing force is greater than the opening force, the valve is closed and will remain closed as long as that condition exists. As pointed out in *Closing Pressure Operation,* these forces are in equilibrium when testing for the *minimum* closing pressure of the valve.

When the valve is open, the distance the valve is off the valve seat is proportionate to the force applied against the spring tension.

As previously stated, the maximum valve opening pressure is the pressure required to overcome the force of the spring tension with no back pressure against the valve. With back pressure present and effective upon the cross-sectional area of the valve seat, it is an aid in overcoming the closing force of the valve. It is evidence, therefore, that the greater the back pressure, the lower the opening pressure of the valve. This is a straight line function.

A valve will close at some point between the maximum opening and minimum closing pressures, in proportion to the amount of back pressure against it. The top valves, therefore, will close without their minimum closing pressure being recorded on the surface.

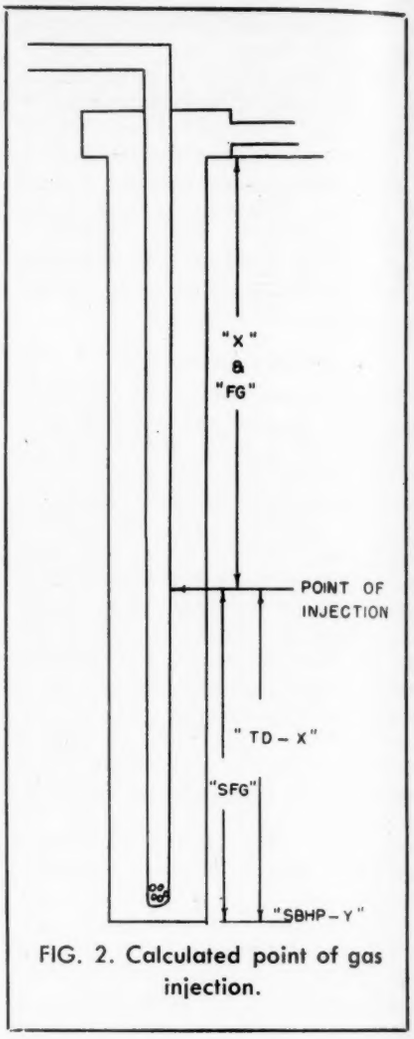

FIG. 2. Calculated point of gas injection.

In continuous flow operation, even though the valves are set and spaced on a predetermined minimum closing pressure, this closing pressure is of small consequence once the valves are in operation. The surface recorded pressure will be greater than the valve minimum closing pressure. It is impossible to designate, from the casing surface recorded pressure, the point of operation in a continuous flow valve string after they are in operation. Such data can be obtained only by pressure bomb survey.

Pre-Installation Well Data

If obtainable, the following data on a well should be known in order to design accurately a continuous flow gas lift installation:

Total depth.
Size and weight per foot of casing.
Size and thread of tubing.
Desired fluid production in barrels per day.
Oil and water percentage.
Static bottom hole pressure.
Static fluid gradient.

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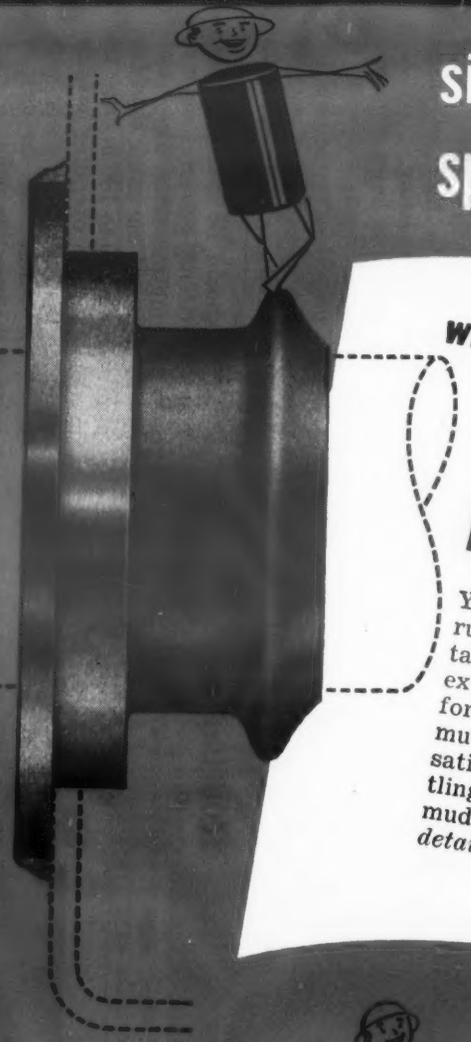

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Estimated flowing fluid gradient.
Productivity index.
Maximum available surface operating pressure.

Usually all these data are not available. In such cases the installation is generally designed to operate at maximum depth with the available surface operating pressure.

Calculated Point of Gas Injection

If sufficient well data are available, the point of gas injection necessary to accomplish the desired results is obtainable. The formula for calculating this injection point is: (See Fig. 2)

$$(X)\ (FG) + SFG\ (TD - X) = SBHP - Y$$

Where:

X — Distance in feet from surface to point of injection required for desired fluid production.

FG — Estimated flowing gradient of fluid column from point of injection to the surface, psi/ft.

SFG — Static fluid gradient in tubing from point of injection to bottom of hole, psi/ft.

TD — Total depth of well in feet.

SBHP — Static bottom hole pressure, psi.

Y — Difference, in psi, between static bottom hole pressure and flowing bottom hole pressure required to produce the desired amount of fluid.

For example, it is desired that 2000 bbl per day be produced from a well 7000 ft deep, static bottom hole pressure 2700 lb, productivity index 4.0, static fluid gradient .45 psi per foot, estimated flowing gradient .18 psi per foot.

The equation under these conditions would be:

$$(X)\ (.18) + .45\ (7000 - X) = 2700 - 500$$

Solving this equation we find that the point of gas injection would be 3519 ft. If sufficient gas were injected into the eductor tube at a depth of 3519 ft to reduce the average flowing gradient of the fluid column to .18 psi per foot from that point to the surface, a total fluid production of 2000 bbl per day would result.

Designing Valve Pressures

There are two methods of designing the operating pressures of a valve string.

1. Valves may be set at successively lower test block closing pressures as they are placed lower in the string.
2. All valves may be set at the same test block closing pressures.

Setting the valves at the same test block closing pressures is generally the more desirable and usually the method used.

Valves should be spaced on their minimum closing pressures, never on their opening pressures. The operating pressures of the string should be a minimum of 50 to 100 lb under the available surface operating pressure in order that adequate gas passage might be maintained through the valve at the injection point.

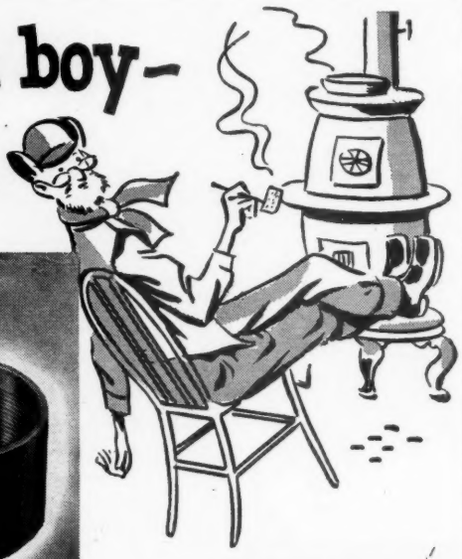
With this type operation either the open or closed type of installations may be used. With the closed type, the annulus is emptied of fluids by transferring it through the valves.

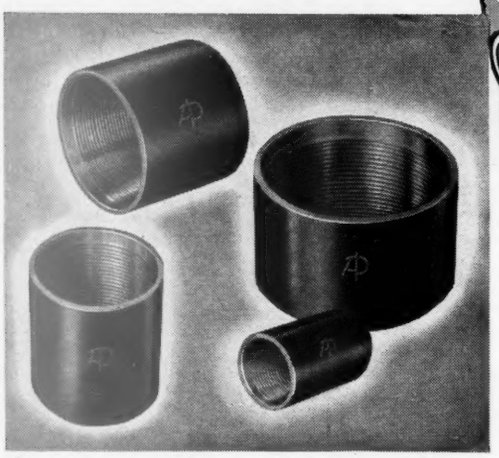
Flowing Gradients

One of the factors in the valve spacing formula is the flowing gradient that can be established and maintained in the tubing fluid column. This gradient, therefore, based on the quantity of fluid to be produced, must be estimated before an installation is made.

Charts are offered (Figs. 3 to 5 Incl.) to show the possible flowing gradient that might be established in different sizes of tubing. The gradients shown on these charts may be

"Since I was a boy—darned near.."





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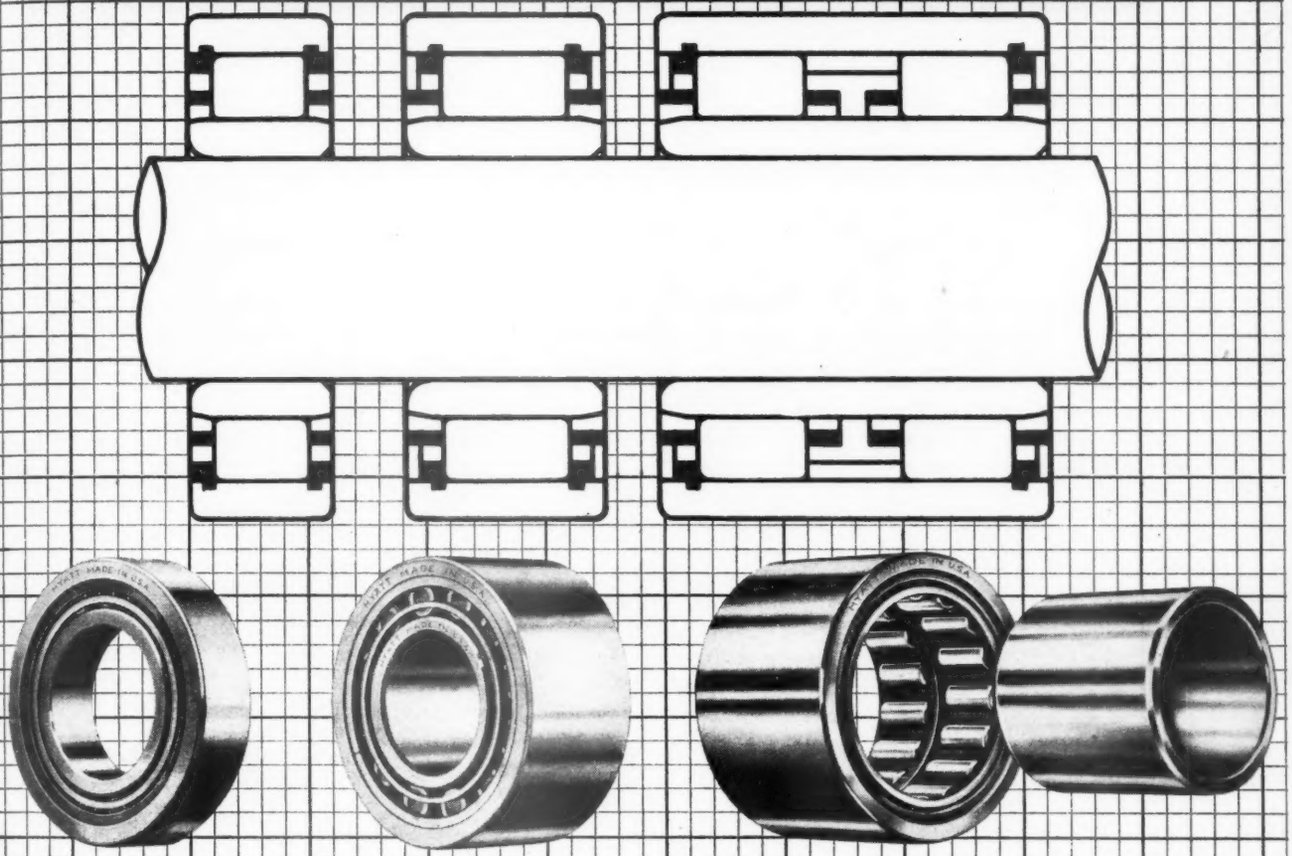

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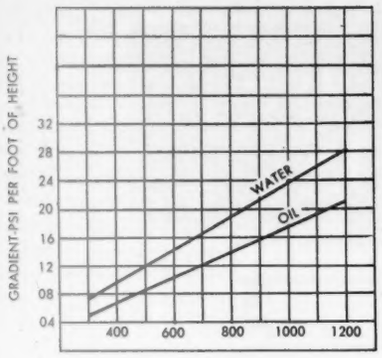

FIG. 3. Flowing gradients—2-in. tubing.

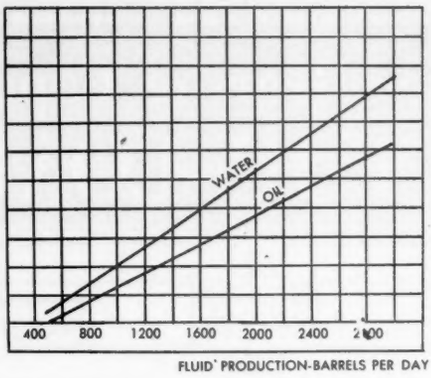

FIG. 4. Flowing gradients—2½-in. tubing.

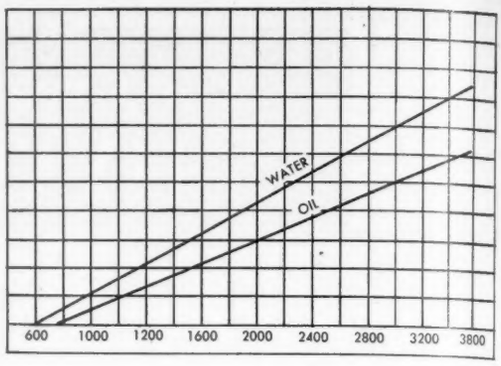

FIG. 5. Flowing gradients—3-in. tubing.

used in the spacing formula for continuous flow operations as the estimated tubing column flowing gradient in psi per foot of height. By varying these gradients slightly and also varying slightly the static fluid gradient in the spacing formula, the positions of the valves in the string are materially affected. An effort should be made to calculate the spacings so that the desired depth is reached with the highest possible flowing gradient.

Pre-installation well data should be sufficient to classify the well definitely and correctly for continuous flow operation. After the valves are in operation, control of the gas injection rate offers a wide range of adjustment to obtain a most efficient producing rate.

Spacing of Top Valve From Surface

Spacing of the top valve from the surface is determined by the static fluid level in the well and available surface operating pressure. Where the static fluid level is at or near the surface, the spacing of the top valve from the surface is calculated by the following formula:

$$S = \frac{P - D}{SG}$$

Where:

S — distance in feet of first valve from the surface,

P — available surface operating pressure—PSI,

D — desired differential across the valve when exposed to annulus gas—PSI,

SG — static fluid gradient — PSI/FT.

For example, with 600 lb available surface operating pressure and a desired differential of 50 lb across the valve when exposed to annulus gas, a static fluid gradient of .45 psi per foot, the top valve would be spaced:

$$\frac{600 - 50}{.45}$$

= 1222 ft from the surface.

Spacing Top Valve Under Static Fluid Level

Usually fluid can be "pressured" back into the producing formation at a rate proportional to the productivity index. With this characteristic present, it is not always necessary to consider the U-tubing effect of the fluid, therefore, the top valve may be spaced considerably below the static fluid level. This is accomplished by pushing the fluid back into the producing formation with pressure applied at the surface, depressing the annulus fluid level to a point where the top valve is exposed to annulus gas pressure.

This is possible, of course, only when no packer is used and the annulus is left open (open installation), or when a packer is used but no standing valve is installed in the tubing string (semi-closed installation). If a standing valve is installed in the tubing string and a packer is used (closed installation), fluid cannot be pressured back into the formation.

It is necessary to know accurately the static fluid level. With these data, the top valve is spaced below this level in accordance with the available operating pressure.

The formula would be:

$$S = SFL + \frac{P - D}{SG}$$

Where:

S — Distance in feet of first valve from surface,

SFL — distance in feet of static fluid level from surface,

P — available surface operating pressure—psi,

D — desired differential across the valve when exposed to annulus gas—psi,

SG — static fluid gradient—psi/ft.

For example, with a static fluid level 800 ft from the surface, available surface operating pressure of 600 lb, desired differential across valve of 100 lb when exposed to annulus gas and a static fluid gradient of .45 psi per foot, the top valve would be spaced:

$$800 + \frac{600 - 100}{.45}$$

= 1911 ft from the surface.

Notice that when this formula is used in spacing the top valve from the surface a differential of 100 lb when exposed to annulus pressure is used instead of 50 lb as in the first formula.

When operation is started on a well with the top valve spaced in this manner, a time element must be considered before "kick-off" occurs. If the well has a high productivity index the "kick-off" might occur within a period of 30 minutes to one hour. In a well with a low productivity index it might be necessary to pressure up and close the annulus in for a period of 12 to 24 hours before the fluid level in the annulus is lowered to the point of the top valve in the string.

When annulus pressure is applied to a well of this type, fluid in the annulus is depressed and proportionately raised in the tubing until the columns are balanced. Fluid may be produced on the surface before this balancing occurs. After they are in balance the producing formation will take fluid an amount equal to the psi of the annulus pressure. In the foregoing example, if the static fluid level is correct, the valve placed at 1911 ft from the surface would be exposed to annulus gas pressure with a differential of 100 lb across it at the time.

Spacing Top Valve With Closed Installations

Where the static fluid level is at such depth that the available operating pressure is less than that required to balance a column of fluid equal in height the distance from the surface to the static fluid level, the ratio of the annulus and tubing areas must be taken into consideration. Under these

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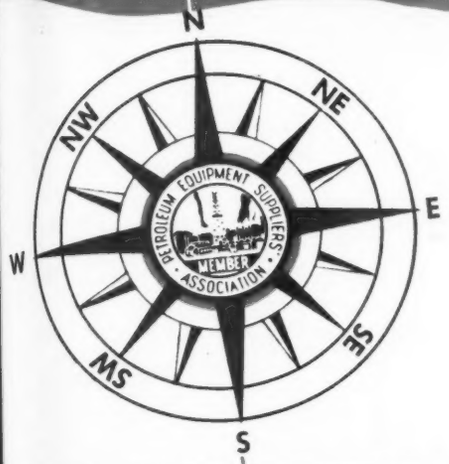

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conditions, the formula for spacing the top valve from the surface would be:

$$S = SFL + \frac{P - D}{SG \times (1 + R)}$$

Where:

S — Distance in feet of first valve from surface,
SFL — distance in feet of static fluid level from surface,
P — available surface operating pressure—psi,
D — desired differential across valve when exposed to annulus gas—psi,
SG — static fluid gradient—psi/ft,
R — ratio of annulus area to tubing area.

For example, with a static fluid level 1500 ft from the surface, an available operating pressure of 600 lb, a differential of 50 lb desired across the valve when exposed to annulus gas, static fluid gradient of .45 psi per foot, well equipped with 5½-in. 14-lb casing and 2-in. EUE tubing (ratio 4.9 to 1), the top valve would be spaced:

$$1500 + \frac{600 - 50}{.45 \times (1 + 4.9)} = 1707 \text{ ft from surface.}$$

In continuous flow gas lift operations this formula is rarely employed in spacing the top valve from the surface except in closed type installations.

Spacings Between Valves

After the top valve in the string has been spaced from the surface, the spacings between the valves under the top valve are based on the operating valve pressures and the estimated flowing gradient in the fluid column. These spacings are calculated by the following formula:

$$S = \frac{(TBP) - (DVA \times FG)}{SG}$$

Where:

S — Spacing in feet of valve below the valve above,
TBP — test block closing pressure of valve above, psi,
DVA — depth of valve above in feet from surface,
FG — estimated tubing column flowing gradient, psi/ft,
SG — static fluid gradient, psi/ft.

For example, with the top valve installed in the string at 1222 ft from the surface and set to operate at a test block closing pressure of 550 lb, a static gradient of .45 psi per foot and an estimated flowing gradient of .18 psi per foot, the spacing between the top valve and the second valve from the top would be:

$$\frac{550 - (1222 \times .18)}{.45} = 733 \text{ ft}$$

The spacing of the third valve in the string below the second valve would be:

$$\frac{550 - (1955 \times .18)}{.45} = 440 \text{ ft}$$

Calculations of spacings on this basis are continued until the desired depth is reached or the spacings become less than 100 ft apart. When the spacings become this close, the maximum operating depth is being approached and additional valves seldom justify their cost.

Where it is known that the fluid production will be in the neighborhood of the eductor tube capacity, a jet collar is sometimes placed in the string below the bottom valve. Calculations for spacing this jet collar are by the same formula as for spacing the valves in the string but a slightly lower flowing gradient factor is used. For instance, if a gradient of .18 psi per foot is used in calculating the valve spacings, the jet collar might be spaced on a gradient of .15 psi per foot.

The jet collar is a safety factor for inaccurate well data. If it becomes possible to produce lower in the hole than calculated, the jet collar becomes exposed to the annulus pressure and will materially assist in the operation

REDUCE *Scraping Time*

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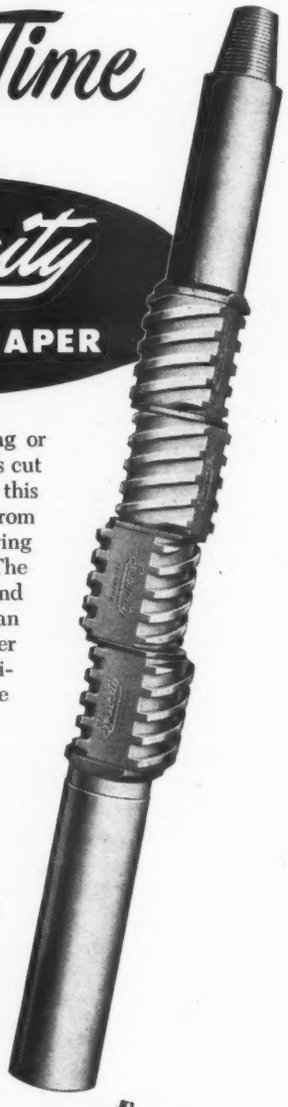
CASING SCRAPER



The Security Casing Scraper, when run on tubing or wire line, reduces scraping time because the cutters cut on the up stroke as well as the down stroke. In this manner, all vertical motion is utilized to remove from the casing walls undesirable obstructions, assuring the free passage of subsequently run equipment. The double acting cutters remove perforation burrs and cement, leaving the inside surface of the casing clean and smooth, preventing damage to packers and other sealing tools. The Security Casing Scraper, in addition to being run on wire line or tubing, may be run on drill pipe with rotary equipment.

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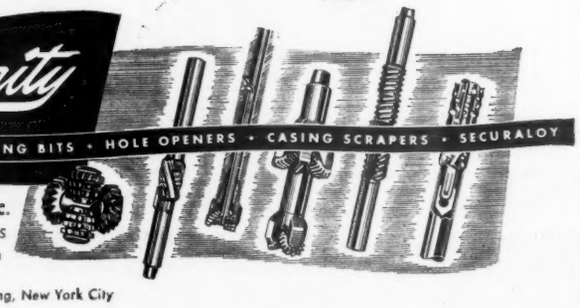

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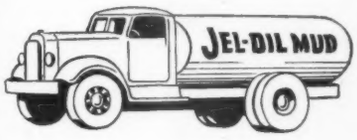

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of the installation. If it is questionable that the well will produce fluid in large quanities, it is possible that the jet collar would cause the installation to lack control and be a decided disadvantage. Therefore, it is recommended that it be used on high productivity index wells only.

In order to understand the importance of correct valve spacings, the principle of the spacing formula must be analyzed and understood. Referring to Fig. 6, let us assume a pressure opposite valve "A" equal to its test block closing pressure of 550 lb, with this valve spaced 1000 ft from the surface.

Passage of gas through the valve has established an average flowing gradient of .18 psi per foot to the surface. This column being 1000 ft high, a pressure of 180 lb is present inside the tubing at the point of the valve in the string. Fluid in the annulus has been depressed by the annulus pressure to a point where valve "B" is exposed to annulus pressure. With the fluid column from valve "A" to the surface weighing 180 lb, there is a pressure of (550 — 180) 370 lb available for balancing the column of fluid inside the tubing between valve "A" and valve "B." This available pressure of 370 lb divided by the static

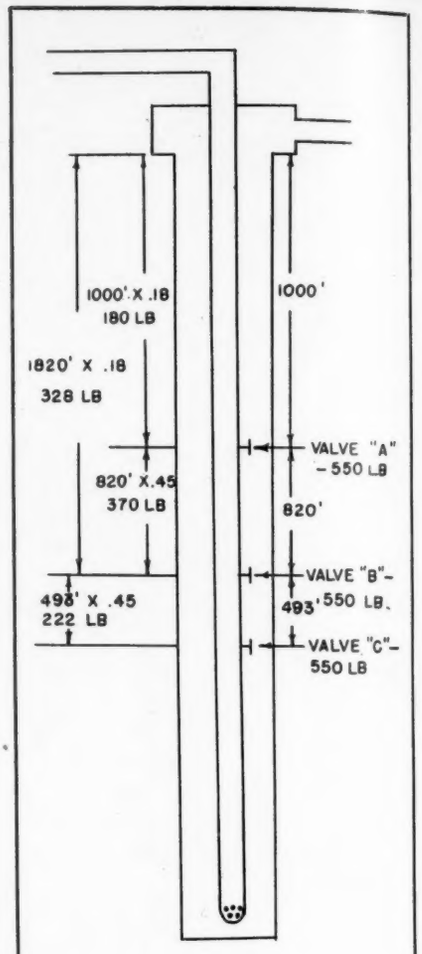

FIG. 6. Valve spacing principle.

gradient of the fluid column, .45 psi per foot, is the maximum length (820 ft) of the fluid column the pressure will support and is, therefore, the spacing between the valves.

When valve "C" is exposed to annulus pressure the weight of the fluid column from valve "B" to the surface is 1820 ft by .18 or 328 lb. Pressure available for spacing is (550 — 328) 222 lb. This available pressure divided by the static fluid gradient of .45 psi per foot gives the spacing in feet between valve "B" and valve "C," a distance of 493 ft.

Minimum Gas Requirements

For calculating the theoretical minimum quantity of gas required per barrel to reduce the static gradient of a column of fluid to a flowing gradient, the following formula may be used:

$$Q = (5.61)\ \frac{(SG-FG)}{FG}\ \frac{(SP+OP+2BP)}{2BP}$$

Where:

Q — Theoretical minimum quantity

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of gas, in cubic feet, required, per barrel to reduce a column of fluid from a static gradient to a flowing gradient,

SG — static gradient of fluid column, psi/ft,

FG — flowing gradient of fluid column, psi/ft,

SP — surface separator pressure, psi,

OP — operating annulus pressure, psi,

BP — base pressure of gas.

For example, the theoretical minimum quantity of gas required per barrel to reduce a column of fluid with a static gradient of .40 psi per foot to a flowing gradient of .15 psi per foot, an operating annulus pressure of 500 lb, separator pressure of 30 lb and gas base pressure of 14 lb, would be:

$$(5.61)\ \frac{(.40-.15)}{.15}\ \frac{(30+500+28)}{28}$$

$$(5.61)\ (1.66)\ (19.9) =$$
185 cu ft per barrel.

Casing Flow Operations

Continuous flow valves are especially adapted to casing flow operations. When it is necessary to lift quantities of fluid beyond the capacity of tubing flow, the valves are mounted either inside or outside the tubing string on special mandrels. Gas is injected down the tubing, through the valves into the casing annulus to flow production through the casing.

Spacings of the valves in this type operation are calculated by the same formula as that used for tubing flow. The flowing gradients that can be established and maintained in this type flow are slightly lower than that in tubing flow.

In this type operation, the valves are sometimes utilized to lower the working level to a point where it is possible for the injected gas to enter the casing annulus through the bottom of the tubing. Where exceptionally large quantities of fluid must be produced, greater efficiency is obtained where this can be accomplished.

With this method, it is necessary that flow lines from the well head have a flow area equal to or larger than the flow area of the casing, otherwise, the gas will break through the fluid at the well head and fluid will drop back.

Due to general lack of sufficient detailed information on this type well, it is usually very difficult to calculate initially the proper submergence. Generally, the tubing is raised or lowered until the proper submergence is found to meet production requirements. * * *

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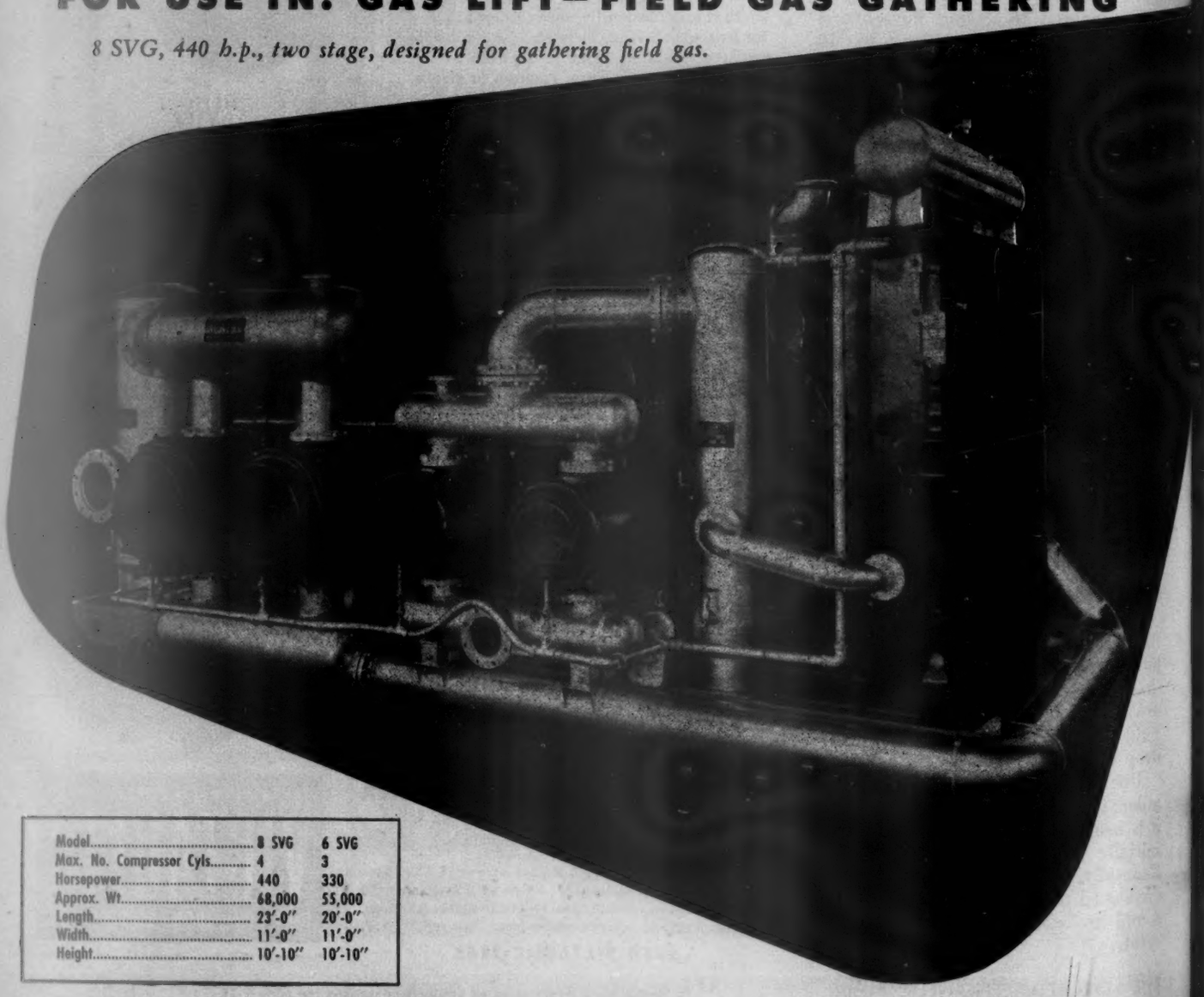

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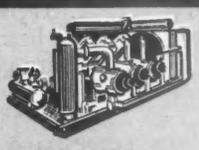

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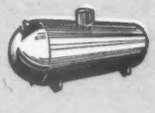

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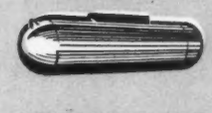

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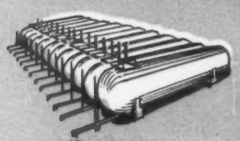

PRESSURE BULK STORAGE

Additional Oil Production Through Flooding with CARBONATED WATER†

JAMES WELLFORD MARTIN*

An ever-increasing amount of development work is being applied to the improvement of the secondary recovery of oil. Up until recently, however, most of this development has been in the application of mechanical and physical means of removing the oil.

Several years ago, in the search for broader markets for carbon dioxide, certain reactions between carbon dioxide and petroleum were found to have commercial possibilities. Work on treating oil sands with carbon dioxide was initiated and this new development in secondary recovery resulted. This development, to a large extent, is the application of chemical means of removing the oil.

General Description

For several years research work has been underway in our laboratories toward the improvement in the recovery of oil through the use of carbon dioxide as a component of both gas drives and water floods. This paper deals particularly with that section of our work covering the results of the use of carbonated water or brine on oil sands.

The results of this work have been most encouraging. When applied under controlled conditions, a relatively dilute solution of carbon dioxide in water or brine seems to condition the sand and its oil content so that a substantial increase in oil recovery results.

The process described herein adds little energy to the reservoir. It is more a chemical treatment of the sand than it is a source of energy.

Under certain conditions a 25 per cent solution of carbon dioxide in water is capable of removing better than 75 per cent of the recoverable oil. In Fig. 1 is shown the effect of carbon dioxide concentration on oil recovered. This curve is drawn with the percentage of total oil recovered at pressures of 800 psi and temperatures of 75 F. The first 25 per cent carbonation of the water conditions the sand so that approximately 75 per cent of the oil can be recovered. One hundred per cent recovery is taken as the total oil that can be removed from the sand by carbonated water.

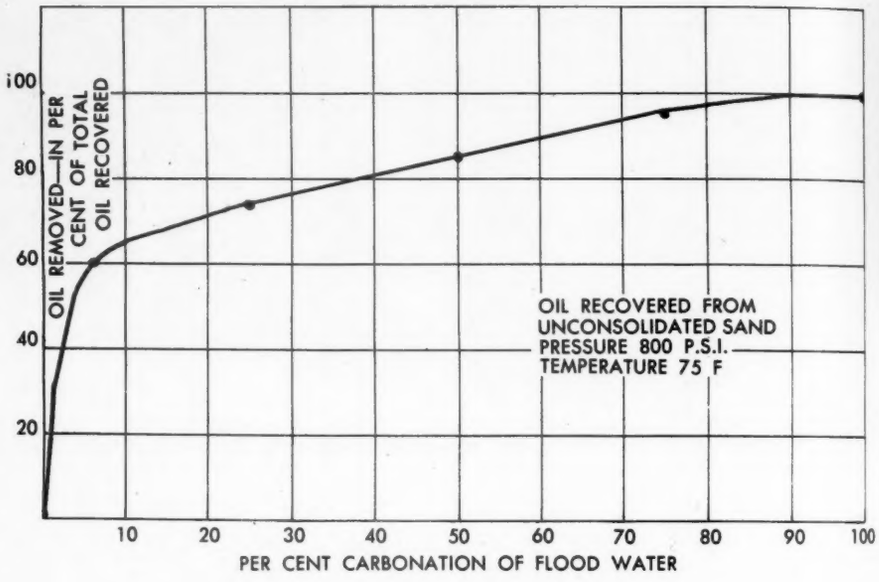

FIG. 1.

As an example of its application to actual cores, one set of tests run on some 35 Mid-Continent cores gave the following average results. This is shown in Fig. 2.

Estimated initial residual oil—30 per cent of pore space.

Estimated residual oil economically recoverable by any present methods—23 per cent.

Actual residual oil after treating cores with carbonated water—8 per cent.

Factors That Influence the Recovery of Oil

Our laboratory work has shown that the following factors affect the recovery of oil by this new process:

1. **The degree of carbonation of the water.** As is shown in Fig. 1, the oil recovery increases with the degree of carbonation of a water, but past a certain degree of carbonation (in the neighborhood of 20 to 30 per cent of full carbonation), the amount of oil recovered increases more slowly with increased carbonation.

It does not require high concentrations of carbon dioxide to cause reactions bringing about the release of the major amount of oil from the sand. These reactions are accomplished by this relatively dilute solution of carbon dioxide in the oil and water. Because of the relatively small proportions of carbon dioxide that are required this phenomena makes the commercial utilization of this process possible.

Additional increase in oil recovery above what was brought about by this limited concentration of carbon dioxide is in the nature of a straight line function, and is probably dependent largely on the increase in formation volume that is brought about by the solution of carbon dioxide in the oil. In many sands one may not be warranted in attempting to obtain this last incremental increase in oil recovery through the use of more concentrated carbon dioxide.

We are speaking at the present time about the recovery of oil by carbonated water and not by mixing carbon dioxide in any gas drive.

2. **Temperature of the oil sand.** It has been found that increased temperature promotes the recovery of oil when carbonated water is employed.

†Presented before 28th Annual Meeting, Pennsylvania Grade Crude Oil Association, Pittsburgh, Pennsylvania, June 14, 1951.

*Consulting engineer, Oil Recovery Corporation, New York City.

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. . . 3 *The drill collar's hard heat-treated surface that reduces gripping efficiency.*

and 4 *The relatively low drill string weight available for wedging the slips into the bowl.*

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For example, note in the table how a Baash-Ross Drill Collar Slip that fits a 7" diameter drill collar will also fit *any* diameter down to 5½". Adjustment for wear is automatic and continuous throughout the working range!

This means that Baash-Ross Drill Collar Slips automatically take a *full* grip on any drill collar within their range—a grip that gives adequate support to compensate for the continuous wear which changes drill collar diameters . . . for the hard heat-treated surface . . . and for the lack of drill string weight.

Sizes and Operating Ranges of Baash-Ross Drill Collar Slips

SIZE*	Operating Range	
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A	3"	4½"
B	3¾"	5¼"
C	4¼"	5¾"
D	5½"	7"
E	6¾"	8¼"

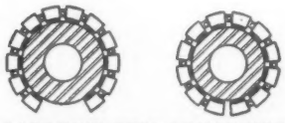
*(all sizes available in both "Regular" and "Long" types)

TWO TYPES

Baash-Ross Drill Collar Slips are available in two types —"Regular" and "Long." The "Long" type has extensions above the gripping area to provide a seat for the Baash-Ross Safety Clamp — the clamp that puts a non-slip, *yet removable,* "stop shoulder" on *any* drill collar to compensate for the hazards of flush design when supporting the collar in the table. For complete details see your nearest Baash-Ross representative — or write direct!

The "why" of Baash-Ross Drill Collar Slips

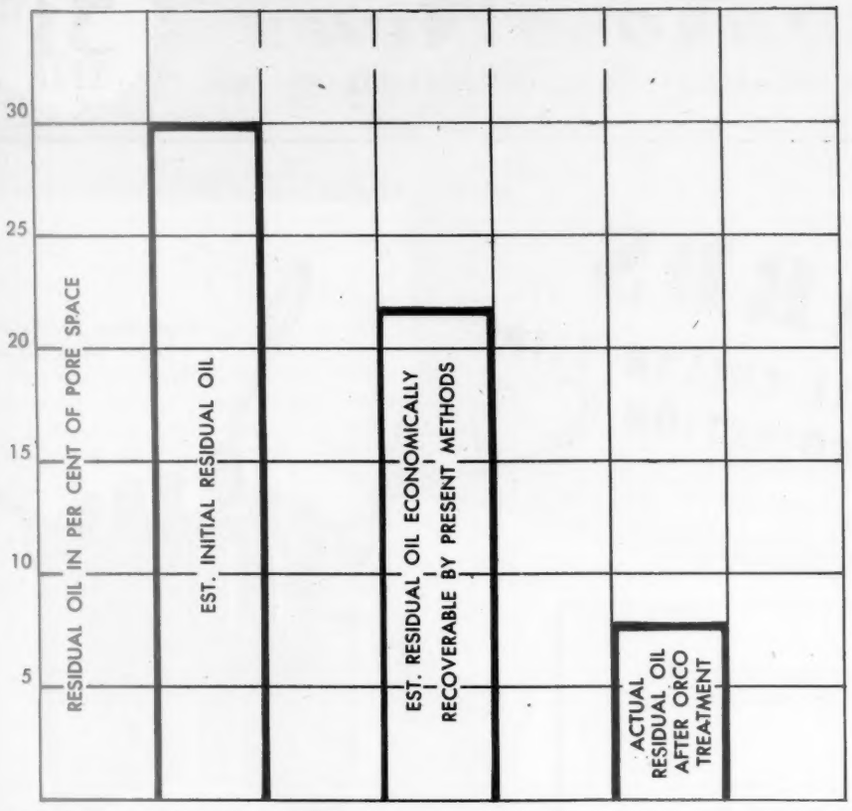
ORDINARY SLIPS that fit the drill collar when new (A) are unable to adjust themselves to smaller diameters as the drill collar wears away. Result, grip becomes less and less adequate (B) and risk of a costly fishing job constantly greater.



BAASH-ROSS DRILL COLLAR SLIPS consist of many narrow slip segments flexibly linked together. Result —they w-r-a-p around the drill collar and always take the same *full* grip whether drill collar is new or worn, round or out-of-round.

LINERS ARE EASILY RENEWED

To insure long life, minimum maintenance and maximum gripping efficiency at all times, the liners in Baash-Ross Drill Collar Slips can be readily renewed by simply pulling a stainless steel pin, sliding out the worn liner, inserting a new liner and replacing the pin. *It's simple, quick and inexpensive!*



Space average of 35 Mid-Continent cores.

FIG. 2.

This is a general statement. We hope soon to be able to publish curves showing the effect of temperature on both low-temperature oil sands and on the high-temperature sands of the South and West.

3. **Pressure of the oil sand.** Oil recovery increases with increased pressure starting at a minimum of approximately 500 psi at normal temperatures and for most crude oils. Below this critical pressure the effect of pressure increase on oil recovery is small. Above this critical point the effect of pressure is increasingly greater.

4. **Nature of the crude oil.** Generally speaking, it can be said that oil recovery using this process increases with the API gravity. The lighter oils are best. It appears to be better with certain paraffinic base oils than with naphthenic but is better with naphthenic than with asphaltic and would be even better with aromatic type of crude oil than with paraffinic. (See Fig. 2.) The above statements are only indicative as there are variations within these general rules.

It is noteworthy that on a curve similar to that given in Fig. 1 if one uses an asphaltic type crude the curve becomes almost a straight line. In the paraffinic, naphthenic, and aromatic, one obtains a sudden and unexpected curve in the lower concentrations of carbon dioxide.

5. **Natural gas content.** The oil recovery increases with the natural gas content of the crude oil. In case the crude is "dead," it will probably pay to pre-inject some natural gas.

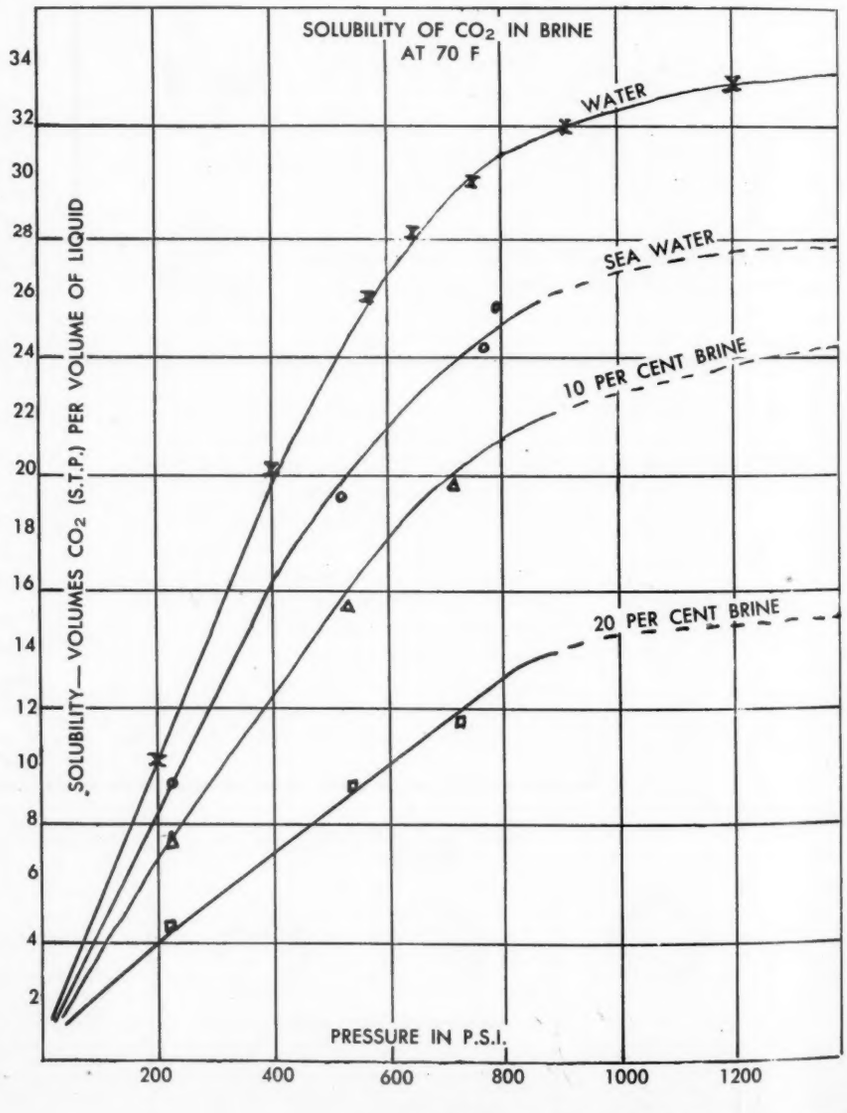
Some Results of Field Tests

The above information is based largely on laboratory work done on unconsolidated sand and work done in a commercial core laboratory on a wide variety of actual cores.

At the present time there are two field tests underway. Both of these field tests are on depleted sands, i.e., on sands that have been water flooded to their commercial limit and the carbon dioxide treatment, as applied to them, could be called a tertiary recovery rather than a secondary recovery.

There are good reasons to believe that this process can best be applied as a component of an initial water flood where water-oil ratios are still low rather than as a tertiary recovery after normal water flood is completed.

FIG. 3.



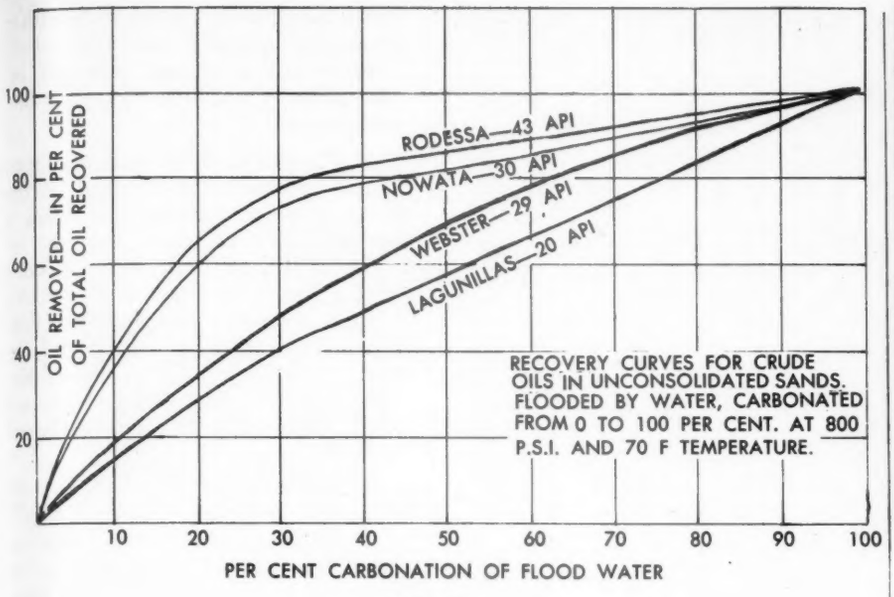

OIL REMOVED—IN PER CENT OF TOTAL OIL RECOVERED
RODESSA—43 API
NOWATA—30 API
WEBSTER—29 API
LAGUNILLAS—20 API
RECOVERY CURVES FOR CRUDE OILS IN UNCONSOLIDATED SANDS. FLOODED BY WATER, CARBONATED FROM 0 TO 100 PER CENT. AT 800 P.S.I. AND 70 F TEMPERATURE.
PER CENT CARBONATION OF FLOOD WATER

FIG. 4.

Such tests as these on watered out areas, however, have the virtue of giving assurance that whatever oil is recovered is due solely to the introduction of carbon dioxide.

The first test in Allegany County, New York, was a test flood on a half acre five spot and while incomplete we now have results of 17 months' operation that include the peak of oil production.

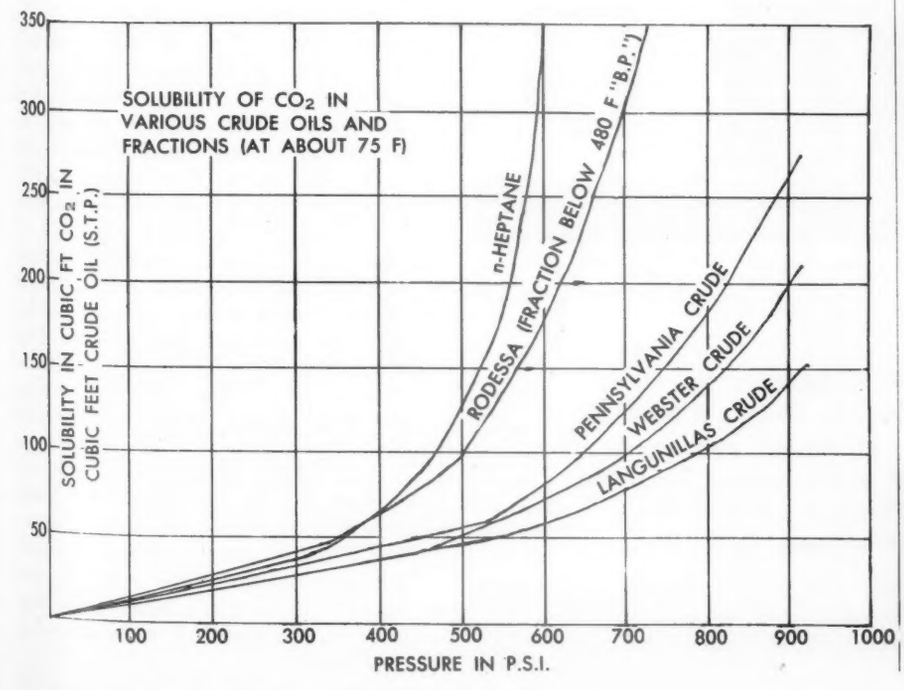
The second test, began 15 months after the first test, is situated in northern Oklahoma and consists of four 5-spots covering a total of 10 acres. Carbon dioxide is now being injected prior to beginning a follow-up water flood. Results of the treatment will not be evident in this latter test area for several months.

In the first, and as yet incompleted, test, the following phenomena have been observed:

1. **Increased injectivity.** The use of carbonated water increases the water injectivity of the oil sands. The injectivity of some injection wells were increased approximately 50 per cent, and in other wells in fairly tight sands, relatively small amounts of carbonated water doubled the injectivity.

The field work done so far could well indicate that this factor may assist in developing certain tight sands.

FIG. 5.


SOLUBILITY OF CO_2 IN VARIOUS CRUDE OILS AND FRACTIONS (AT ABOUT 75 F)
SOLUBILITY IN CUBIC FT CO_2 IN CUBIC FEET CRUDE OIL (S.T.P.)
n-HEPTANE
RODESSA (FRACTION BELOW 480 F "B.P.")
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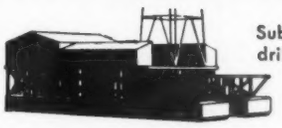
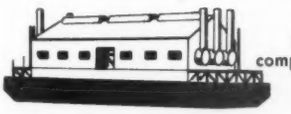
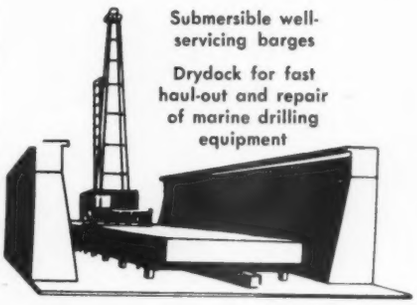

Submersible drill barges

Tugs


Boiler and compressor barges

Water, oil, and supply barges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In the automotive field Briggs & Stratton is the recognized leader and world's largest producer of locks, keys and related equipment.

The work on cores from carbonate reservoirs indicates that injectivity is substantially increased although actual porosity increases to only a limited extent.

2. Production of natural gas. Use of carbonated water promotes the production of natural gas from a water-flooded oil sand. In some oil sands that had been water flooded over a period of years, and in which the gas content of the oil was less than 25 cu ft of natural gas per barrel, the amount of natural gas produced during the carbon dioxide flood increased to approximately 300 cu ft per barrel of oil.

The gas so produced was a remarkably rich gas.

Whether these lighter hydrocarbons were originally in solution in the water of the oil sand or came from the oil is still an open question.

3. Production of unsaturated hydrocarbons. The use of carbonated water brings about an abnormally high percentage of unsaturated hydrocarbons (ethylene, propylene, etc.) in the produced gas. In an actual field test the produced natural gas which, prior to the advent of the carbonated water in the sand contained less than 1 per cent unsaturated hydrocarbons, increased in unsaturated hydrocarbons to around 20 per cent.

4. Production of organic acids. The use of carbonated water promotes the production of organic acids or their salts in the oil sand. Not only were the organic acids found to be present in produced water, but evidences of their solvent action on the minerals in the sand were also found. The sand appeared to have been treated with organic acids because of the nature of the salts washed out of the sand. Among the salts that came out was a heavy production of barium sulfate and carbonate and it was difficult to explain otherwise inasmuch as water had been passing through this sand over many years prior to this time. During the test flood we produced large quantities, over a ton of barium sulfate and carbonate. Calculating it back it is hard to believe that much barium sulfate and carbonate could be produced and put into solution, even though it had been transformed into barium bicarbonate; on the other hand it happens that barium formate, barium propionate, and some of the other organic salts are extremely soluble, as soluble as calcium chloride. This seemed to us evidence that organic acids had been formed, but in addition actual analysis was made of the organic acids in the produced water and they were proved to be present.

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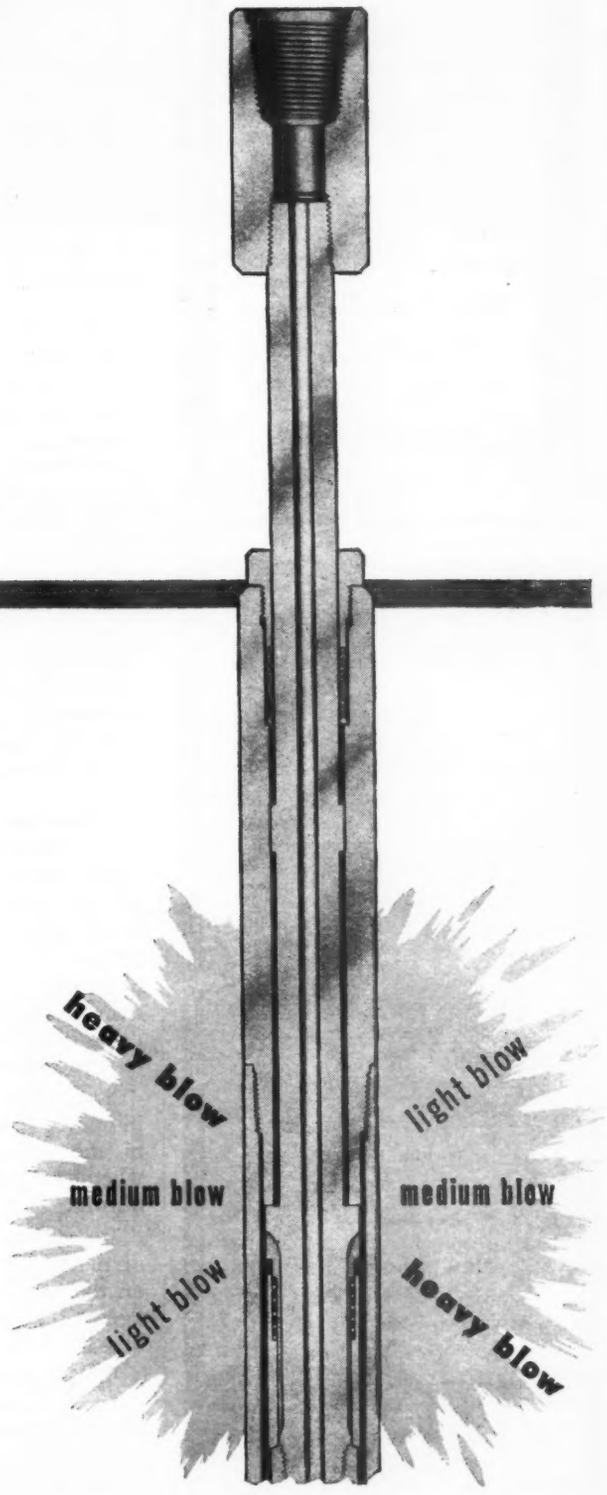

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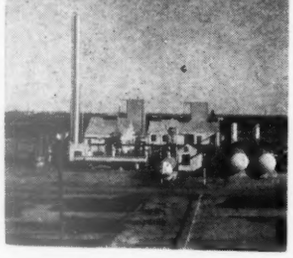

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5. **Corrosion.** When carbon dioxide or carbonated water is used in the controlled concentrations mentioned above, no evidences of corrosion were noted in the production wells or in any of the equipment used in handling the produced fluids.

There is reason to believe that the carbon dioxide forms sufficient amounts of alkali and alkali earth carbonates and bicarbonates so that these salts become buffers that prevent the corrosion of the steel.

Examination of coupons and analysis of the produced water for iron indicated that virtually no corrosion was caused by the use of carbonated water.

6. **Production well plugging.** The use of carbonated water does not present any difficult problems due to deposition of solids at the production wells and separators. Various alkali earth carbonates are formed and largely stay in solution, but if they precipitate, like this barium sulfate and barium carbonate mixture, they tend to flow out with the produced water and were caught in the separator where they settle out. They do not plug the wells and their removal as a suspension in the produced water is not difficult.

7. **Recovery of carbon dioxide.** A large proportion of the carbon dioxide used in this treatment is recoverable and is suitable for reuse. It is believed that as much as 75 to 85 per cent of the carbon dioxide originally injected may be separated and reused thereby limiting the cost of the treatment.

8. No change in the nature of the oil by this treatment could be noted.

Carbon Dioxide Works to Promote Oil Recovery

1. Carbon dioxide reacts on some of the components of crude oil to form polar compounds. As one example, there are formed fatty acids and their salts. It is known that these compounds bring about a marked lowering of surface tension and also have effects on surface action in the sands.

2. Carbon dioxide is soluble both in oil and in water and thus penetrates to the surface of the sand grains whether the sand grain is water-wet or oil-wet.

3. Carbon dioxide has a property of materially limiting the adsorption on the sand of certain surface active agents thus enhancing the usefulness of such adjuvants.

4. Carbon dioxide under high pressure has the property of forming loose compounds (or complexes) with some of the components of crude oil. These newly formed compounds are much lower in viscosity than the original crude. It can be said that they act as solvents for the crude oil.

5. Carbon dioxide promotes the solubility of natural gas in crude oil. It appears that natural gas is more readily soluble in the hydrocarbon-carbon dioxide compounds than in the crude oil. The two gases thus complement each other in their effect on the removal of the oil from the sand.

6. Increased injectivity is possibly brought about by several reactions:

(a) Carbon dioxide decreases the pH of the oil sand adjacent to the injection well. This would limit bacterial growths that now tend to plug the injection area.

(b) It also acts as a solvent for certain salts such as calcium carbonate whose crystals clog the passages between the sand grains.

(c) It is thought possible that the presence of carbon dioxide tends to shrink some of the clay found in an oil sand and thus render a dirty sand more permeable.

Summary

The treatment of an oil sand with a relatively dilute solution of carbon dioxide in water or brine so conditions the sand that more oil may be recovered than is possible with ordinary water flood or gas drive.

It now appears that we can expect to get the residual oil down in the neighborhood of 10 per cent even though the residual oil left after water flooding is in the neighborhood of 25 per cent.

It is thought that the action of the carbonated water is chiefly chemical and is influenced by temperature, pressure, and nature of the oil.

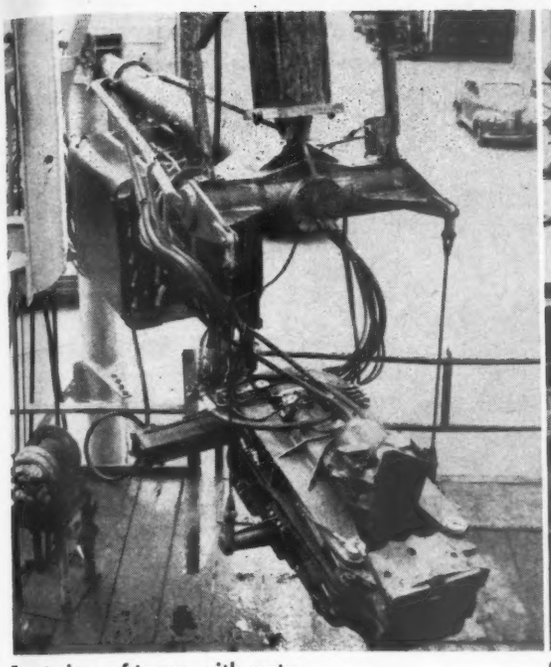
The injectivity of water into the oil sand is improved by means of carbonated water.

This treatment promotes production of certain petroleum gases.

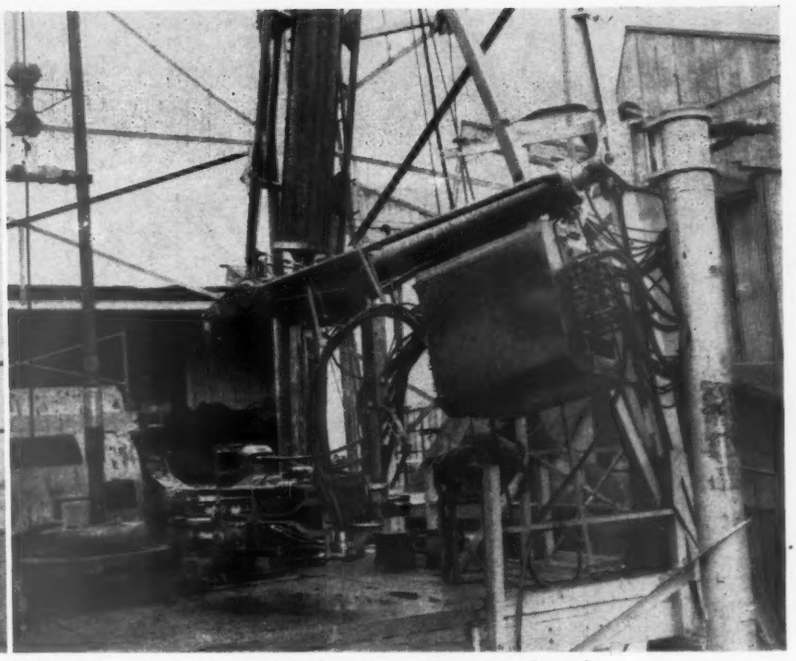
Neither corrosion nor deposition of solids have offered serious handicaps to the field application of the process.

Carbon dioxide can be produced in the oil fields on a commercial scale for about $15 per ton of carbon dioxide. This cost contemplates production of carbon dioxide from fuel oil and includes delivery of the gas at pressures above 800 psi and also includes amortization of the plant in 10 years. Carbon dioxide plants designed for this service may be readily dismantled and removed by truck to new locations.

The cost of the incremental oil produced by this method may be in the range of 35 cents to 90 cents per barrel, depending on field conditions. These figures contemplate that recovered carbon dioxide is reused. * * *



Front view of tongs with gate latches in the closed position.



Side view of power tongs showing valve panel and cylinder carrying the arm for up or down movement. Movement in and out is controlled by cylinder inside the arm.

Power Equipment *Revolutionizes* Drilling Operation

OIL men are trooping to the Byron Jackson plant in Los Angeles to witness the operation of a drilling rig that is about as fully automatic as a drilling rig can be. Equipped with a remotely controlled power pipe racker, power elevator, remotely controlled power tong unit, power slips, and a master control console, round trips of drill pipe can be effectively and speedily handled by three men whose main function is to operate the score or so of nobs and levers by which the various units are controlled. There is no back-breaking physical labor involved. All the manipulation of slips, tongs, elevators, and the racking of the pipe, which are the normal accompaniment of running in or out of the hole, are performed by the power equipment and never a human hand is laid on the drill pipe.

Designed for modern deep drilling with its prospect of harder formations, more frequent bit changes, and more round trips with longer strings of pipe, this power operated equipment takes the work off the back of the crew, maintains a uniform rate of pulling or running pipe, even in unfavorable weather, and greatly reduces normal efficiency loss occasioned by physical fatigue.

The set-up has many safety features. For example, dangerous spinning chain and tong lines are not necessary, so the usual hazards of pipe handling and racking on the floor are eliminated. The derrickman in this instance works from a sitting position on an enclosed platform, and from that position remotely controls elevator handling and pipe racking work.

For years the oil industry has endeavored to devise ways and means of staying on bottom for a longer period of time, and at the same time, to reduce the hazards handling drill pipe on round trips.

The tool makers and oil companies, which design the equipment and work with it, must and do keep these important objectives in mind. The results recorded by Byron Jackson Co., one of the leaders in tool making design, will be of value to every one who is interested in more efficient drilling and greater safety when drilling. Equipment described here is power-operated with remote controls. It can cut the round trip time of the pipe by 25 to 30 per cent and its controlled operation provides greater safety to the driller.

The remotely controlled pipe racker actually consists of two air-motor-powered, chain drive racker units, one between the eleventh and twelfth girths of the derrick and the other just above the first girth. Each arm can be controlled for travel into and out of the working area of the derrick and is also track mounted for full travel across the side of the derrick, on a horizontal plane, without either the derrick or floor man leaving his seated position.

On the end of the lower racker arm is a claw that encircles the pipe on contact. This claw consists of a "U" shaped fork which encloses 180 deg of the circumference of the pipe. A hydraulicly operated latch is closed around the pipe by operating a valve.

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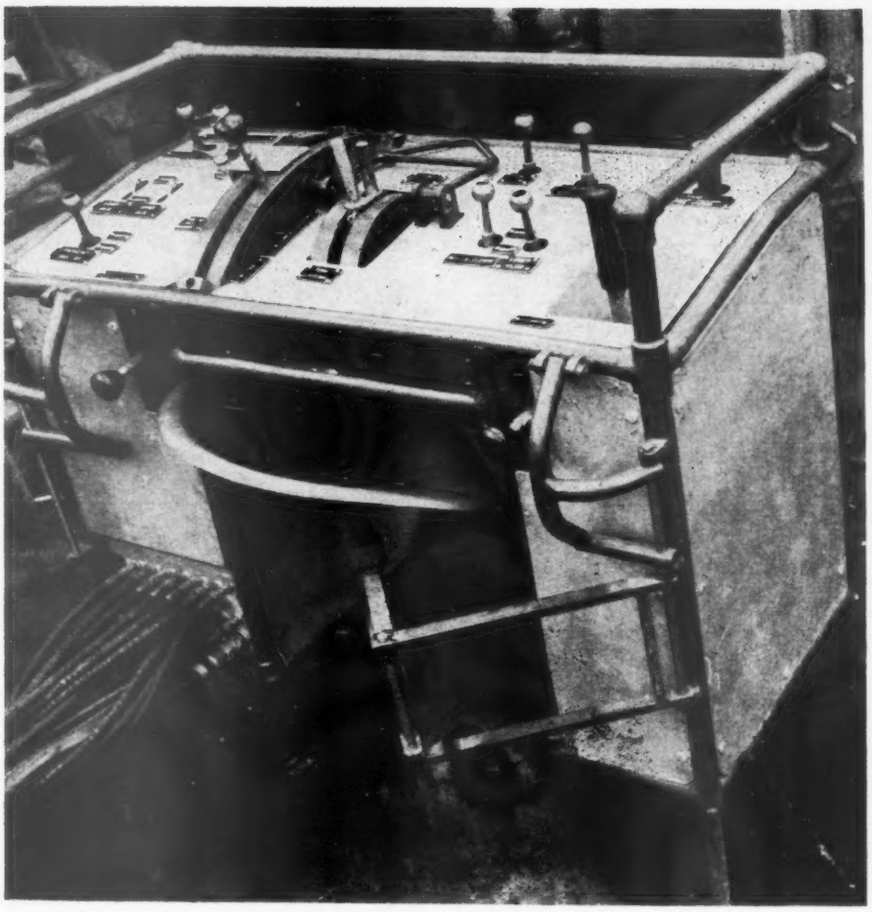
Master control console from which are manipulated the lower racker, tongs, hoist for single elevator, rotary clutch, and throttle for diesel engine when rotating out.



Control of the upper racker is through a single control "joy stick" operated by the derrickman from his stationary platform.

The lower pipe racker is much the same as the upper, except that control is through the master console. An auxiliary elevator is provided to support the weight of the pipe and transfer it to the pipe mat. The auxiliary elevator consists of a "U" shaped member that is built to fit around the pipe being racked. A hydraulically operated spring return claw with teeth situated in one leg of the "U" shaped member is rotated into engagement with the pipe for hoisting and backing up pipe while rotating out. A pneumatic cylinder, mounted at the water table, is connected by a cable to the auxiliary elevator and is controlled from the control panel on the derrick floor.

Compressed air does the work in deflecting the traveling block and op-

View up inside the derrick showing the empty elevator being deflected on the way down by the air operated deflector mechanism.

The upper racker showing the rail on which the transfer elevator slides. This mechanism either guides the pipe or grips and lifts it while spinning out.

erating the elevators. Two air actuating cylinders mounted on the traveling block deflect the block by means of small wire lines from a carriage on the special derrick rail. Counter-tensioning keeps the block at a uniform three feet off center as high as the monkey board, above which the block approaches the center of the derrick. The elevators are latched and unlatched by air operation and are controlled by the driller. Coming out of the hole, the stand is pulled up into the derrick and the slips are set. The derrickman moves the upper racking arm to grip the top of the stand. The driller on the derrick floor trips the elevator release and deflector valve, which side tracks the block as it is lowered by the driller control. The stand is then broken out using the power tongs and racking arms. Going in the hole, the reverse of the above procedure is used.

The power-operated tongs consist of two pipe-gripping units suspended from a telescoping arm clamped to the derrick leg. A hydraulic cylinder controls the height of the tong from floor level to operating position. The tongs consist of power-operated jaws in frames with gates and latches. The upper jaw contains spinning rollers driven by an air motor, and the gate has idler rollers that extend for spinning and retract for tonging. The tongs have a range from 4 to 8¼ in. OD, and are capable of properly controlling the make-up torque on tool joints within this range. They have enough break-out torque to break the tightest joints.

Power slips are pressure raised and pressure set by the touch of a foot pedal. Pipe is pressure centered, assuring on-center gripping of slips. Byron Jackson's unique "packaged piston rod flange assembly," containing built-in pressure relief valve and pilot operated safety valve, are outstanding features. The pressure relief valve releases the air in the upstroke portion of pressure cylinder in the event the arm ring is accidentally struck by the elevator. The pilot operated safety valve holds the slips in position in the event of an air line failure. In addition, a built-in throttle control valve permits the operator to manually adjust the unit to the desired operating speed. These slips can be unitized with the rotary table and installed and moved as a unit with the table. Only a small sub-base is needed, and no changes in the rig structure are normally required.

Side opening permits quickly placing slips in proper operating position around pipe and removing them just as easily. The slips rotate with rotary table without roller bearing contact with slip ring. Powerful air-operated cylinder provides for pressure raising and setting of slips. Two simple air hose connections provide the foot pedal control from driller's position. When swinging slips into operating position, spring loaded latch centers slips and holds them over rotary table. Latch is easily released by hand when moving unit out of working position. Only 90 lb of air pressure are required for these slips to operate. Standard equipment includes a pressure regulator to govern pressure. Positive lubrication is assured with a line lubricator that provides automatic lubrication of control valves and power cylinder. Slip ring rollers and slip carrier rollers are easily lubricated through alemite fittings.

The master control console centralizes the power controls into one board. This means that the floorman does not have to ride the tongs any more, but can sit at the control console and operate the tongs and pipe racker from one position. Not only does this speed up the operations, but it allows complete coordination through one man. The derrickman still operates the upper racker and the driller operates the drawworks, elevator and power slip, thus making the entire drilling run a 3-man operation.

* * *

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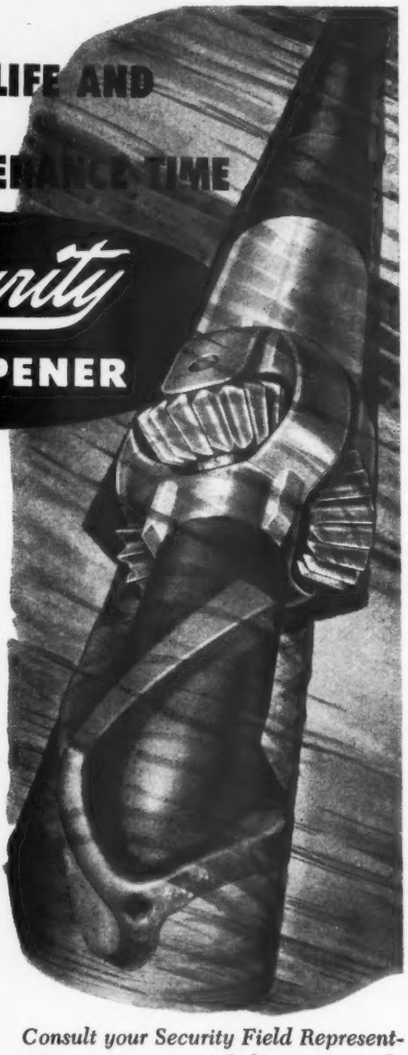

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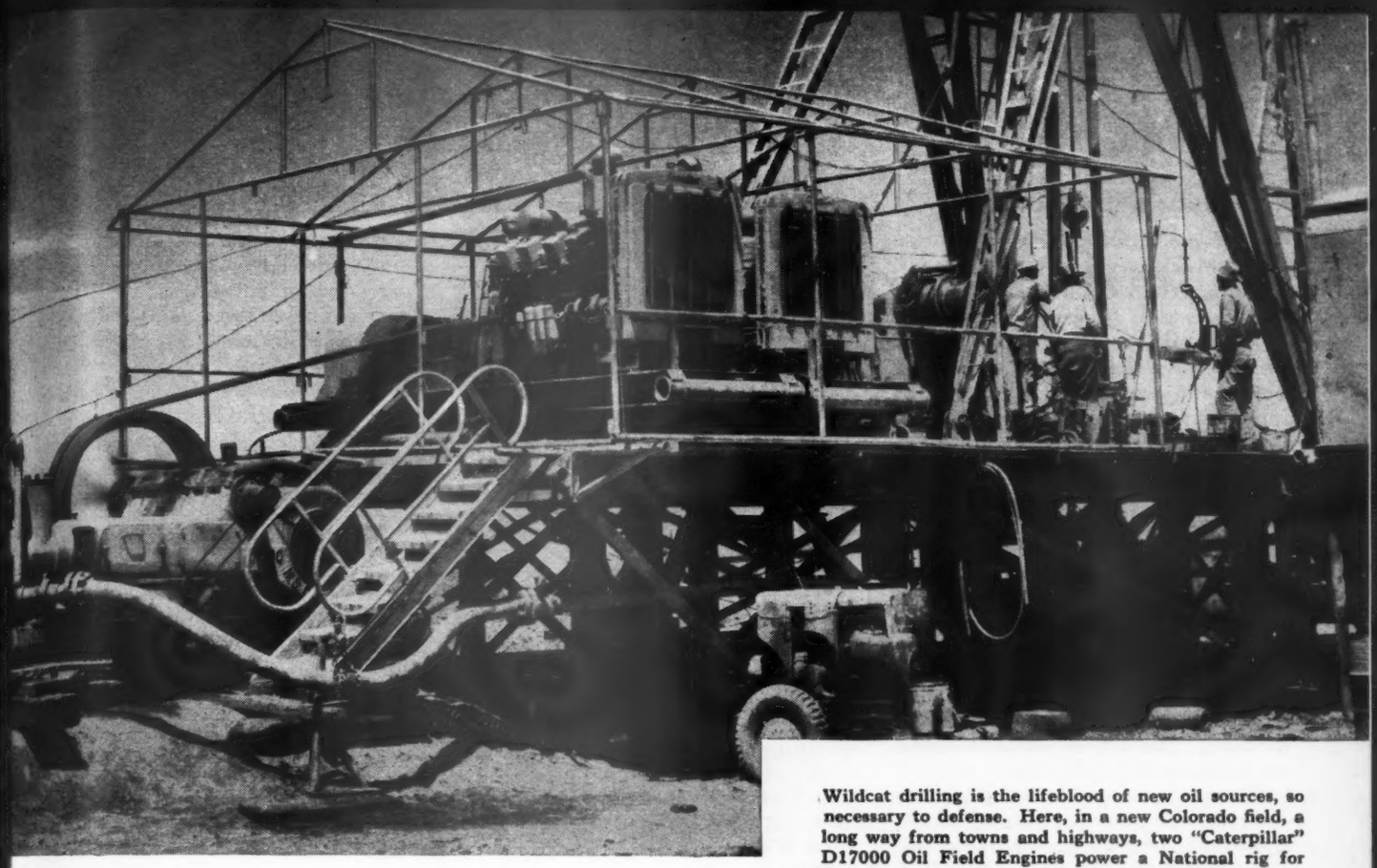

Wildcat drilling is the lifeblood of new oil sources, so necessary to defense. Here, in a new Colorado field, a long way from towns and highways, two "Caterpillar" D17000 Oil Field Engines power a National rig for Reserve Drilling Co., of Glenrock, Wyoming.

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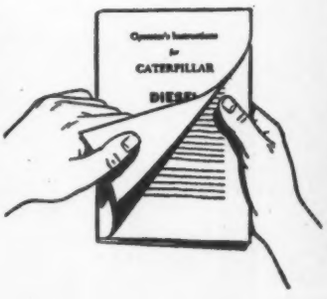

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NEWS

Geophysical Exploration Notes 21st Anniversary

This year is the twenty-first anniversary of the founding of the Society of Exploration Geophysicists. It was organized in 1930 by a group of geologists and geophysicists in Houston, Texas, who recognized the need for interchange of ideas to develop and improve geophysical techniques in exploration for oil. The list of charter members include 46 names, among them such well-known geologists as Alexander Deussen and Donald C. Barton. Today the society membership exceeds 2700 in 41 states and 49 foreign countries. There are 8 local sections and 3 student sections who hold monthly meetings to discuss important technical problems for the professional advancement of their members. Additional local sections, are in process of formation.

The scope of professional interest embraces all problems related to scientific exploration for mineral resources of all kinds in the earth's crust.

Venezuela Oil Output

The Colon Development Company, Ltd., has reported that its production in Venezuela totaled 449,262 bbl for the five weeks ending July 2, 1951.

Secondary Recovery Studied At Gulf Engineering Meet

Steady progress in getting more oil out of the fields now being worked was reported by three production engineers to the Gulf Oil Production Engineering Conference in Pittsburgh, Pennsylvania recently.

Describing the gas lift program in West Texas, where it is being applied on a larger scale by Gulf than any other firm, J. R. Hamilton, area petroleum engineer, the Fort Worth division, revealed:

"We have proof that some reservoirs are being depleted with gas lift that could not otherwise have been depleted to the present stage."

The program is effectively depleting wells that could not be produced by other common artificial lift means, he said. In addition it is achieving the depletion of some wells where sand conditions prevent use of conventional pumping equipment.

A secondary recovery program where about 12 per cent of the stock tank oil originally contained in an East Venezuela field was produced under gas and water injection into the reservoir, was described by George W. Dawson, reservoir engineer, Mene Grande Oil Company.

The method eliminated the need for added wells to recover the oil, promoted continuation of natural flow, tended to shorten production time, and held promise of resulting in increased total recovery, he said.

Reporting on a study of secondary recovery projects in the Gulf Coast district, R. V. Cruce, Houston division, said that outstanding benefits are resulting in additional oil recovery, reduction of operating expense, and the reduction of the length of the depletion period.

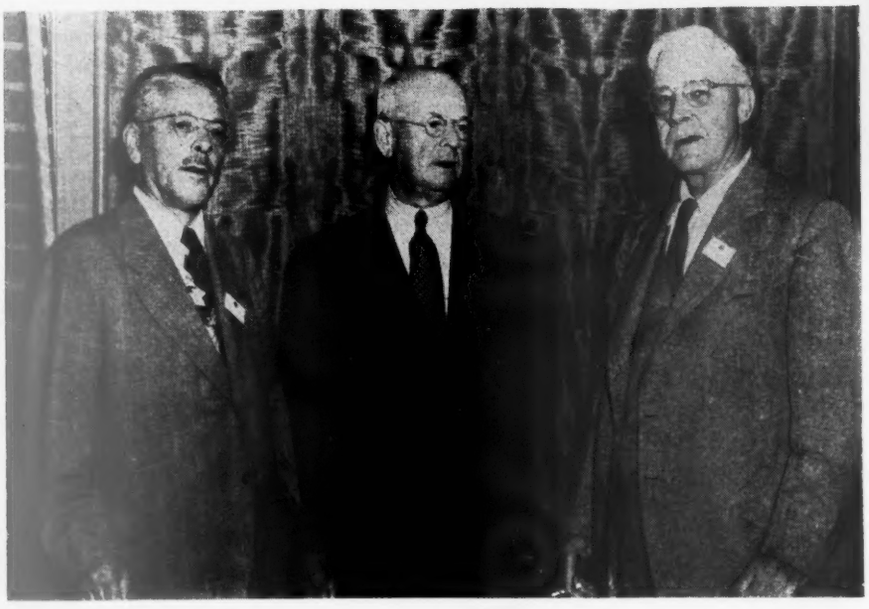
Recoverable reserves have been increased appreciably in the East Texas field by such techniques, he reported. This field, after producing 1,727,000,000 bbl of oil by 1942 was placed under water injection, and since then 1,060,000,000 additional barrels have been recovered.

Crude Oil Output Sees Sharp Rise in May

Iran's May oil production rose sharply above that of April's, possibly due to an attempt to get all the oil possible out of Iran before nationalization of Anglo-Iranian's oil properties went into effect. Production figures for June are not available as yet, but are expected to drop sharply.

Crude oil output in May amounted to 716,551 bbl per day compared with 565,335 bbl a day in April. May output was only 10,200 bbl below the daily average for last December, highest in the company's history.

Gulf hosts of the Production Engineering Conference below: Dr. Paul D. Foote, executive vice president, Gulf Research and Development; Dr. Joseph E. Pogue, Gulf Oil director, who gave the opening address, and Dr. K. C. Heald, vice president, production



Above are E. Boaden, superintendent of production opertions, Kuwait Oil Company, Ltd., F. E. Hatfield, assistant to vice president for exploitation, Fort Worth production division, Gulf; E. C. Masterson, manager oil department, London, Kuwait, and K. B. Conway, special assistant to the vice president, production department, at the Gulf Production Engineering Conference in Pittsburgh.

Production of Sucker Rods More Exacting, CIME Told

The modern sucker rod requires precision work in each manufacturing operation to meet the exacting demands in pumping today's deeper oil wells, D. R. Dale, chief engineer of the S. M. Jones Company, told members of the Canadian Institute of Mining and Metallurgical Engineers at a recent meeting in Calgary, Alberta, Canada.

Dale pointed out the average depth of producing wells in 1950 was 3,698 ft, as compared to an average well depth of 1200 ft in 1892 when the first all-metal sucker rod was developed. Present wells are being pumped at depth greater than 10,000 ft.

With new alloys now available, sucker rod failures have been reduced and the rods have better balanced physical qualities, Dale said. In 1938, nickel-plated rods were placed in service and some are still being used. Today, research engineers are experimenting with plastic and rubber-coated rods, some are testing stainless steel rods, but results are not conclusive and these rods have not been introduced to the market.

He said the beginning of rod pitting is usually the beginning of rod failure. With modern manufacturing methods, the rods are completely heat treated to eliminate the demarcations at the ends of the rods resulting from forging the ends. Formerly, the ends were the most susceptible to failure, but with complete normalizing, a new uniform structure is achieved in the entire rod.

Scaling on the rods from the heat treatment is beneficial, Dale said, only if the scale remains intact and tight. When the scale is loose, localized pitting soon begins. To remove the loose scale, the rods are shot peened and this also hardens the surface of the rod, giving the finished product a greater fatigue resistance.

The modern rod, Dale explained is constructed to precision specifications. The body of the rod must be aligned with the threaded ends. The threads must be of close tolerance to assure a good fit with the coupling. Couplings are made of case-hardened steel because they absorb most of the wear when the well is being pumped.

Murphy Oil Gets Producer

A new Stephens County, Oklahoma, well has been drilled by the Murphy Oil Company. It is the No. 6 Payne, which after jet-perforating four shots per foot at 5700-5845 ft, flowed two hours through ½-in. choke at the rate of 100 bbl oil per hour. Operator is now testing on small chokes, with total depth at 5960 ft.

B of M Engineers Study Diamond Drill Bits

Bureau of Mines engineers have expressed the belief that drilling diamond-tipped drills will last longer if each diamond is set in the bit so that its hardest part will cut the rock and ore, and are attempting to prove this belief in research work. Head of the research work in Bluemont, Virginia, is Albert E. Long, who reported that research has indicated a substantial savings in diamonds may be effected by using the harder areas of diamonds. This process is in reverses to that used by gem cutters who cut and polish the softer directions of the stone.

Pacific Coast Section of SEG to Meet in November

November 1 and 2 is the date set for the annual meeting of the Pacific Coast Section, Society of Exploration Geophysicists. Robert Dyk, of General Petroleum Corporation, president of the society announced that the meeting will be held in the Ambassador Hotel in Los Angeles, California. As last year, the meeting will be held in conjunction with the annual sessions of the Pacific Coast AAPG and SEPM groups and co-ordinated programs will be given.

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Attending the June meeting of the Los Angeles Nomads are: Seated, E. G. Dobson, Texas Company of Venezuela; V. O. Walker, Arabian American Oil (Dharan); Thomas D. Foster, Standard Vacuum Oil, (Indonesia); Charles B. Ward, Kern Oil, Trinidad, and standing, George Wuitzleben, Amarada Petroleum; Lester Noell, Drilling and Exploration, Argentina; J. C. Green, Iraq Petroleum, and William Reis, Philippine Oil Development Company.

W. R. "Frosty" Martin, left, president of the board of Harbor Commissioners, Long Beach, chuckles over remarks by H. E. "Hi" Cassidy, The McCarty Company, on making Frosty a retired member of Los Angeles Nomads at their June meeting.

Saudi Arabian Oil Output Hits New Levels in June

New oil production records were set in Saudi Arabia recently when Arabian American Oil Company announced that its June output averaged 758,705 bbl daily. This compared with the previous high in May of 739,780 bbl daily.

Crude oil production for the first six months of 1951 amounted to 121,496,404 bbl, an average of 671,251 bbl per calendar day.

California Oil Industry Seeks More Tubular Steel

Estimated steel requirements for the California oil industry, based on the number of wells needed to maintain present producing rates, have been presented to the Petroleum Administration for Defense in Washington. The estimate was presented by E. E. Pyles, and was prepared by a representative group of operators who met at the offices of Oil Producers Agency of California.

It showed that not less than 27,000 tons of oil well casing and tubing per quarter would be needed to maintain California's present production of approximately 975,000 bbl per day.

Drilling and oil well completion rates for the first six months of 1951 indicate steel consumption at the rate of 36,000 tons per quarter, the estimate showed. The report urges the PAD to allocate steel to California operators on the basis of the amount needed to maintain supply, rather than on the number of wells drilled in 1950, the present method.

Los Angeles Nomads Have Gadget Show

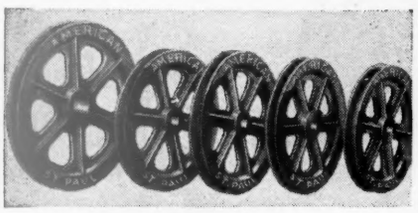
Don Davis, self styled Gadgeteer, brought a large collection of new and unique implements to the Nomads June meeting at the Jonathan Club and set off an inventive fever that may soon turn the petroleum industry upside down. A tea kettle with 14 improvements, a golf tee that eliminates hooks and slices, a bathtub crutch, a device for enabling two people to read the morning paper at the same time —these and many other gadgets held the attention of the audience. A large crowd was present, and saw Frosty Martin inducted by Hi Cassidy as the first "retired" member of the Nomads. Hi paid tribute to Frosty's long record of service in the oil industry.

Jerry Engstrand, presiding, had Herb Cooley, president of the Tulsa chapter, as guest at the head table.

Jim Hughes introduced gadgeteer Davis and floored the crowd when he referred to Nomads as "cosmopolites and sophisticates".

California Well on Pump

A new well in the Poso creek area of Kern County, California has been completed. It is Independent Exploration Company and Oceanic Oil Company's Conoco 101. The well has been completed on the pump at the rate of 114 bbl a day of 12 gravity oil.



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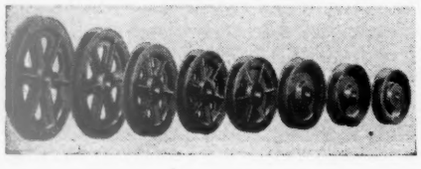

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WHAT'S DOING IN DRILLING

Kansas Well Flows From Arbuckle Zone

The West Hazel pool of Stafford County, Kansas is scene of another field well, the No. 2 Walters completed by Cities Service Oil Company. The well has been completed for an initial production of 2822 bbl of oil daily. It is producing from the Arbuckle zone, topped at a depth of 3665 ft.

Venezuelan Well Drilled

A semi-wildcat well has been completed in the El Roble concession, eastern Venezuela by Pantepec Oil Company, C. A. The well is producing from the Colorado M sand at about 10,000 ft. A flow of more than 600 bbl a day of 55 gravity oil is indicated. Flow is through a ½-in. choke.

Mississippi Field Well Completed by Kirby

The best producer in the Church Hill field, Jefferson County, Mississippi has been completed by Kirby Petroleum Company. The new well is the No. 2 Sam Woods, which was completed flowing at the rate of 206 bbl of 40.5 gravity oil per day through ⅛-in. choke. Tubing pressure was 475 lb. Well was bottomed at 6097 ft.

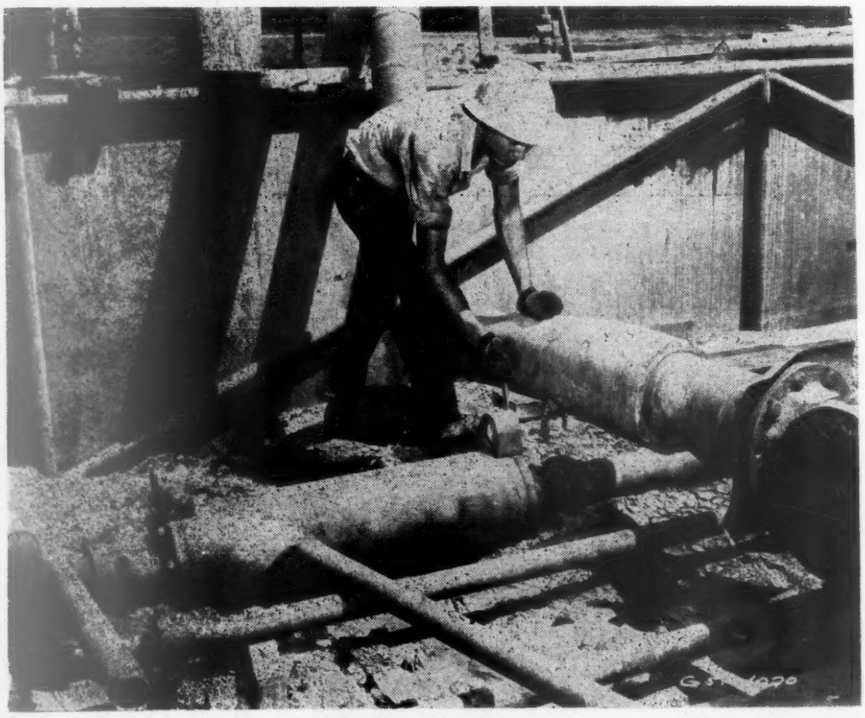
Rotary rigs operating in oil fields of United States and Canada*

Weeks (June)	Total	Gulf Coast	Pacific Coast	Illinois Oklahoma Kansas	Arkansas Louisiana Texas	Rocky Mountain Canada	New Mexico West Texas
Third	2631	582	143	591	154	275	886
Fourth	2680	586	143	614	154	294	889
Weeks (July)							
First	2713	590	156	606	158	299	904
Second	2702	563	151	606	162	302	918
Third	2748	574	145	653	138	305	913
Fourth	2763	604	153	617	164	298	929

*As reported to American Association of Oilwell Drilling Contractors by Hughes Tool Company.

Oklahoma Field Well Is Dually Completed

A dually completed well has been reported by Sinclair Oil and Gas company in the Southeast New Hope pool of Garvin County, Oklahoma. The new well, which flowed 50 bbl of 40.3 gravity oil in 8 hours, through 2-in. choke, is the company's No. 3 Mantooth. The well also is producing 878,000 cu ft of gas per day from the Gibson sand. From the First Bromide formation, the well flowed 93 bbl of oil in 13 hours through 5½-in. casing and ¾-in. choke, with 657,000 cu ft of gas per day. It is plugged back to 7520 ft. Oil from this second formation, First Bromide, was reported by Sinclair to be 43 gravity.



Gulf Coast installation of a fluidynamic desurger on a mud line of a rotary drilling rig. The Hycar sleeve is encased in the large pipe line in the foreground.

Penn Grade Oil Region To Increase Drilling Rate

The Pennsylvania Grade crude oil region must step up its 1951 drilling rate 21 per cent above last year and complete 2630 wells this year to maintain its production rate and assure area refineries a sufficient supply of crude. Last year's drilling in the area embracing southwestern New York, western Pennsylvania, and West Virginia totaled 2157 wells.

Four associations of regional oil producers have joined in submitting this information to the production division, Petroleum Administration for Defense at Washington in a bid for that agency's help in obtaining enough pipe of the proper type to drill the wells.

Tubular goods needed in 1951 were estimated at 17,980 tons. The Bradford field, where a survey of actual drilling plans showed 1400 wells contemplated this year against 1046 last year, would account for 10,011 tons. Allegany County, New York, where 700 wells would be drilled this year, contrasted with 582 in 1950, would take 3,592 tons. The Middle District of Pennsylvania would use 2555 tons in drilling 400 wells, about the same as last year.

Plymouth Well Hits Lower Spraberry Zone

Plymouth Oil Company has brought in a new Spraberry well in the prolific Benedum oil field, Upton County, Texas. This is the fourth producing zone for Plymouth, which has wells in the Fusselman, Pennsylvanian, and the Ellenburger.

The new well is the Elliott No. 1, which flowed at the rate of 480 bbl a day on a $\frac{5}{16}$th of an in. choke. A 425-lb tubing pressure and gas-oil ratio was 796 to 1. The Elliott No. 1 was brought in by the Hydrafrac method.

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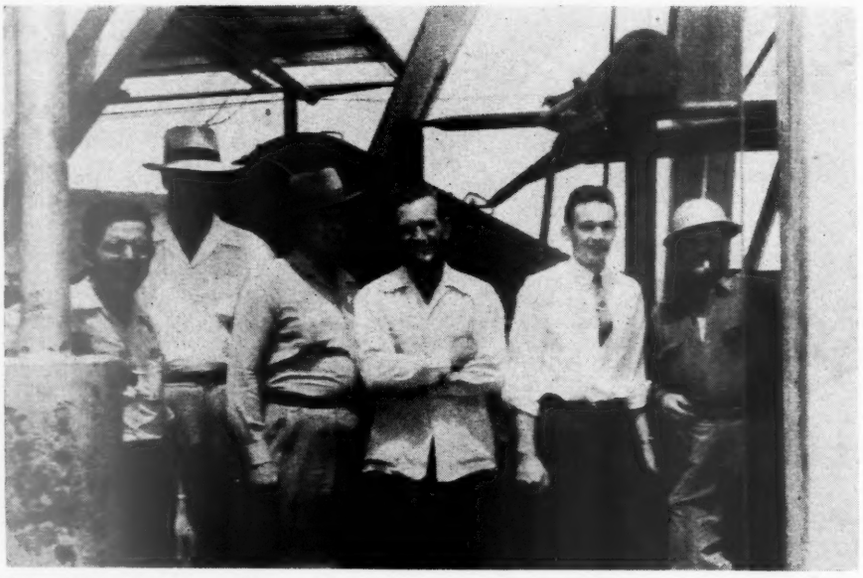
At work in the West Texas Lulu field, Crockett County, are: E. S. Masters, derrick man; Gordon M. Garnett, rotary helper; L. H. Reaves, rotary helper; Ralph Payne, motor man; and Raymond Wood, driller. The field was opened recently, with Brinckerhoff Drilling Company drilling the well for Continental Oil Company. See page B-14.



Standing at the well, Harris Ranch No. 3 in the Lulu field are: Jerry Silhavey, Continental Supply Company; Jeff Jefries and Jack Gray, Emsco Derrick and Equipment Company; Norwood Gilliam, Brinkerhoff Drilling Company, a visiting engineer, and Raymond Wood, driller.

Oklahoma Wildcat Deepened

Producers Development Company has redrilled a once abandoned wildcat, completing it for a 3-zoned producer. The well, formerly drilled by Sinclair Oil and Gas Company, is the No. 1 White, northwest of Norman, Oklahoma.

The No. 1 White flowed 7½ bbl of oil per hour through a 9/64-in. choke with tubing pressure of 1200 lb from the Tulip Creek sand at 9712-52 ft. Subsequent tests on 10.64-in. opened showed the well making 12 bbl of oil hourly with 1100 lb tubing pressure. The well made tests in the Wilcox zone to 9392-9537 ft and the Joins at 10,152-197½ ft and found production in both zones.

New Blackjack Well

A new gas well has been brought in in the new Blackjack field, on St. Charles Ranch, 45 miles north of Corpus Christi. It is Continental Oil and Western Natural Gas companies' first well in this area. The gas well was drilled to 11,255 ft, and is capable of producing 86,000,000 cu ft a day.

McElroy Ranch Offset Drilled by Sinclair

A southern offset to the No. 1 McElroy ranch well in Upton County, Texas has been completed by Sinclair Oil and Gas Company. The No. 1 Windham flowed at the rate of 758 bbl of 53.6 gravity oil in 22 hours through a ½-in. choke. Production is from the Ellenburger limestone through perforations between 12,336 and 12,436 ft.

Kuwait Oil Well Sets Middle East Depth Record

Kuwait Oil Company, Ltd. has reported to have set a new depth record for the Middle East with a 13,729 ft test in Burghan field in Kuwait. The well has been drilling more than a year with some extremely hard formation encountered at the greater depths. Objective of the deep test is to investigate the formations underlying the present Burghan sands from 3500 to 4800 ft.

Previous depth record in the Middle East was held by Ratawi 1, which was drilled by the Iraq Petroleum Company, Ltd., west of Basrah. As far as is known, no other wells in the Persian Gulf area have gone below 13,000 ft.

Union Oil Completes California Field Well

A new well in the Bardsdale field in California has been reported by Union Oil Company of California. The new well is the company's Dryden 23, which has been completed with an initial production rate of 234 bbl of oil daily. Oil is 35.7 gravity. Drilled to a depth of 7337 ft, the well is presently producing 141 bbl daily of 35.9 gravity oil.

San Andres Lime Hit In New Mexico Field

Keller and Peterson have opened production in the San Andres (Permian) lime in the Chisum field of Chaves County, New Mexico. The company's No. 1-A State has been completed for 62 bbl per day on pump from 2023-56 ft. Regular producing formation in this field is the Siluro-Devonian.

Plan Oklahoma Offset Well

Carter Oil Company is planning a 10,350-ft confirmation well in the Northeast Mayfield pool of Beckham County, Oklahoma. The pool opener is the No. 1 A. C. Atwood, which will be drilled as an offset to the No. 1 Garrett, pool opener. The discovery was completed flowing 134 bbl of 40.2 gravity oil in 21 hours through 3/16-in. choke earlier in the year.

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Humble Drills Producer In Hub Field, Mississippi

A good producer has been completed in the Hub field of Marion County, Mississippi. The well is Humble Oil and Refining Company's No. B-1 H. W. Ball. The well flowed at the rate of 176.8 bbl of oil per day through ⅛-in. choke on completion test. Flowing tubing pressure was 1360 lb. Gravity of oil is 31.5 deg. Production is from 9138 to 9141 ft.

Phillips Tests Well In Panther Creek

A new producer is flowing in the southwest Panther Creek pool of Garvin County, Oklahoma, where Phillips Petroleum Company is testing its No. 2 Eligah-B. Plug-back depth of the well is 8242 ft. On test the well flowed 263 bbl of oil in 17¾ hours through ¼-in. opening.

Gulf Sets Two Producers In Mississippi Oil Field

Gulf Oil Company has completed two pumping wells in the East Yellow Creek of Wayne County, Mississippi. One is the No. B-1 Graham-Gulf Unit, which is pumping at the rate of 113 bbl of 20.1 gravity oil per day. Production is from a series of perforations placed opposite Eutaw oil saturated sands between 4722 and 4884 ft.

The second well is the company's No. 7 Robert Graham, which pumped at the rate of 35 bbl of 20.1 gravity oil per day. Producing depth is between 4845-4944 ft.

Wyoming Field Given Shallow Sand Producer

A new field has been completed in the Northeast pool of Converse County, Wyoming. Southern Production and Dyer Drilling Company's No. 1 Carlin Smith-State blew out at a total depth of 1841 ft to flow 100 to 150 bbl of oil per hour from what is believed to be the Shannon sandstone. This is the first well showing from the shallower sand in the immediate area of South Glenrock and Big Muddy fields.

Ecuador Field Well

A new well, the Tigre No. 45 has been completed in the El Tigre field in Ecuador. Manabi Exploration Company, Inc., an affiliate of Canada Southern Oils, Ltd., reported that the new well produced 440 bbl of 40 gravity oil through a ¼-in. opening in the tubing. The new well has been drilled to a total depth of 3392, although it is producing from the Atlanta sandstone topped at 2135 ft.

Cities Service Drills West Texas Well

A prolific well has been completed in the Dollarhide field of Andrews County, Texas, where Cities Service Oil Compay has drilled its Cowden G No. 10. The well has been given a potential of 1970 bbl of oil daily. It is producing 865 bbl daily from the Clear Fork sands and 1105 bbl daily from the Devonian zone. Total potential is 1970 bbl daily through a ½-in. choke.

Pakistan Well Indicates Oil at 8212 Ft

Good oil shows have been found in Pakistan Petroleum's well No. 4 at Chakwal (Punjab) at a depth of 8212 ft. Tests are being made to determine the productive capacity of this well. In March of this year, the well was deepened to 8061 ft to drill into the Sakesar limestone, but shows of oil were disappointing. The present depth of this well is the same as that of Well No. 2, which struck oil in 1949.

Canadian Well Completed

In Alberta, Canada Royalite Oil Company has brought in its Stony Plain No. 2. The well was completed with production on choke at the rate of 1400 bbl of light crude oil a day.

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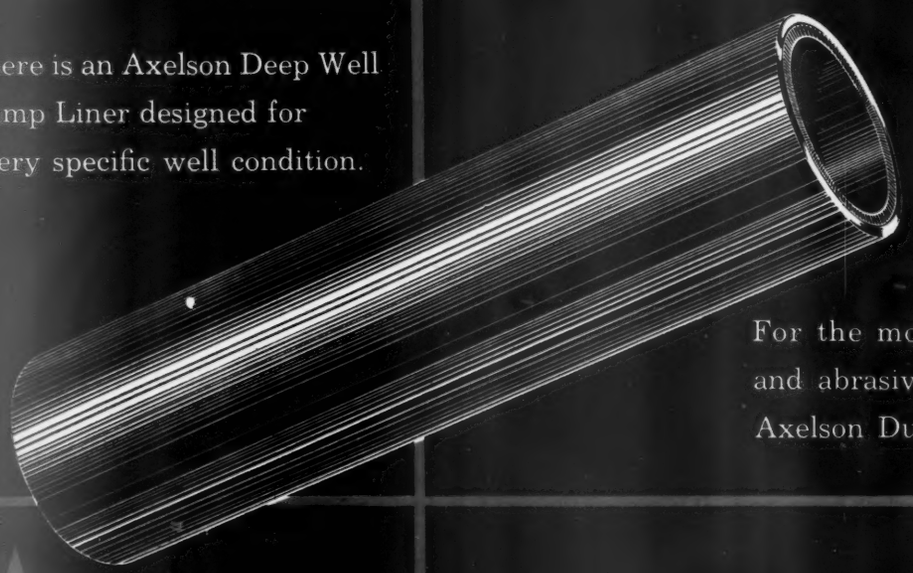

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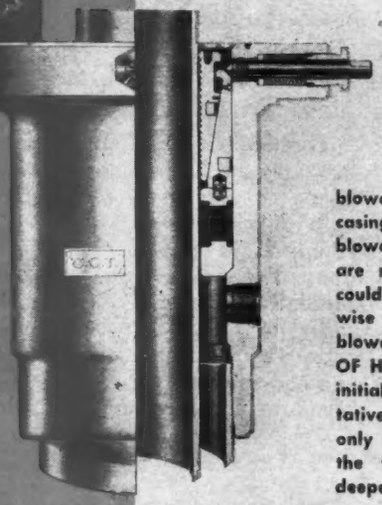

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EXPLORATION ACTIVITIES

Prolific Oil Development Seen for North Dakota

The Amerada No. 1 Clarence Iverson, which set off North Dakota's first oil boom in April, is closed down to fish out stuck drill pipe at 11,955 ft. Continuing development of this latest state to produce oil commercially, Amerada has begun its No. 1 Binhomer-Risseri in the Croff area of McKenzie County.

Some of the other companies moving into what is believed may be a lush oil section are Rudman-Parsons, whose No. 1 Math Iverson remains a location, Union Oil of California and Associates, and Hancock Oil Company and Signal Oil Company's No. 1 Fee in Cavalier County. The Los Nietos Oil Company's No. 1 Lillian Wholetz is to be in Cavalier County. As of June 1, approximately 26,000,000 to 28,000,000 acres were under lease.

New Oil Area Opened In Stonewall County, Texas

Opening of a new oil producing area in Southern Stonewall County, Texas, was announced by Cities Service Oil Company (Delaware) upon completion of the Flat Top 140 No. 1 test well on the 36,940-acre Swenson Flat Top ranch. The well flowed 333 bbl of 40 gravity oil in 24 hours through a quarter-inch choke, with a gas oil ratio of 422 cu ft of gas per barrel. The well is producing from the Swastika sandstone at a total depth of 3403 ft. Cities Service is a 50 per cent owner, with a 25 per cent interest being held by Signal Oil and Gas Company and 25 per cent by Lone Star Gas Company.

Saudi Arabia Gets Its Ninth Oil Field

Oil has been discovered in a wildcat well in Saudi Arabia, it was announced by W. F. Moore, president of the Arabian American Oil Company.

The well, known as Safaniya No. 1, is situated approximately 13 miles southerly from the port of Ras el Misha'ab in northern Saudi Arabia. The well is about 12,000 ft offshore in the Persian Gulf. It is the first offshore well drilled in that part of the world.

Oil was discovered in the Bahrein Zone, the zone from which oil is produced on Bahrein Island in the Persian Gulf and in the Burghan field in Kuwait. From preliminary drillstem tests it has been determined that the oil is sweet and of medium gravity. Operations are continuing at the well and it is planned to core through the producing horizon. Productivity of the well and the extent of the new field are unknown at present.

The discovery at Safaniya brings the number of known oil fields in Saudi Arabia to nine.

Rank Wildcat Is Discovery In Martin County, Texas

A rank wildcat has been opened in Martin County, West Texas, by Pan American Oil Company. The new well has been given a Texas Railroad Commission potential of 2341 bbl daily. Small production is about 8 miles away from the new well, but there is no big production any where near it.

On a 6-hour test, the well made 97.5 bbl of 41.3 gravity oil hourly through a 3/4-in. choke. Production was from a 90-ft heavily-saturated section of the Devonian, with perforations of the top 40 ft of the producing zone from 12,078 to 12,118 ft.

Utah Wildcat Successful

With an estimated production of 240 bbl per day, Carter Oil and Continental Oil Companies' No. 1 Ute Tribal wildcat came in in the Unitah basin area of Utah, in Duchesne County. Reports stated that the well blew out and flowed at an estimated rate of 240 bbl of oil a day. On drillstem test at 7352 to 7552 ft, there was a blow of gas, with recovery of 4680 ft of fluid, part of which was oil.

The discovery was deemed important by Utah oil men because it is some 150 miles from Rangely field, Colorado, which is on the eastern edge of the Unitah Basin. This means the likelihood of a new pool on the western part of the basin.

Louisiana Well Opens New Producing Area

Humble Oil and Refining Company has assured Lafourche Parish, Louisiana of a new oil producing area with discovery of its No. 1-C Louisiana Land and Exploration Company. The wildcat flowed 97.2 bbl of oil daily through a 3/16-in. choke on initial test from 10,262-66 ft. Gas-oil ratio was 9600 to 1. The new well is situated midway between the Golden Meadows and Bay de Chene fields.

General Petroleum Drills New Wyoming Oil Well

An important Wyoming oil discovery has been reported by General Petroleum Company, affiliate of Socony-Vacuum Oil Company. The new discovery is the company's wildcat, Mabel West No. 1, which struck oil at an interval between 7227 and 7281 ft in phosphoria limestone. On a drillstem test, the well flowed at the rate of 720 bbl a day of 34 gravity clean oil, accompanied by sour gas. The company reported that the new well will be drilled ahead for a possible additional productive zone.

New Oil Field Indicated

A new oil area appears to have been opened from Simpson Limestone formations of Ordovican age and southern Andrews County, Texas, by Kerr-McGee Oil Industries, Inc. The new well is the company's No. 1 B-23 University well, which flowed at an estimated rate of 70 to 100 bbl an hour on a drillstem test at a depth of 7944 to 7964 ft. Commercial production from two other formations has been indicated, but drilling is expected to be continued in the Ellenburger formation.

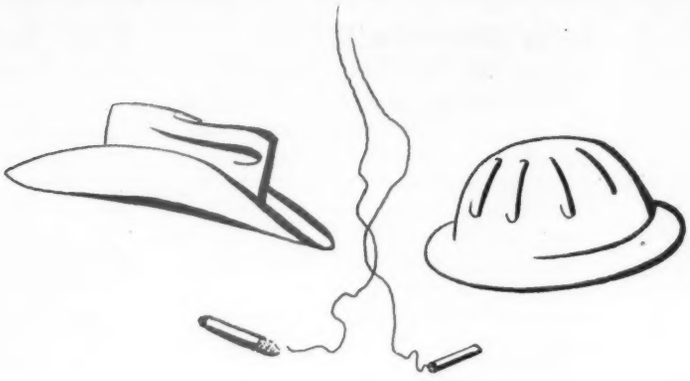
Canadian Gas Well Drilled

A large gas discovery with an oil showing has been made 10 miles northwest of Edmonton, Alberta, Canada. The new well which is being drilled by Wagner Oils and Matlo Oils, Ltd., got a good gas blow of 4,000,000 cu ft daily and a flow of oil in 16 minutes. Pipe is being pulled to determine the oil recovery.

Two Nebraska Wildcats Recover Oil on Tests

Four-hundred and seventy feet of 38-39 gravity oil and 100 ft of heavily oil cut mud has been recovered at Nebraska Drillers' No. 1 Torgeson in Kimball County, Nebraska. The wildcat topped the "J" sand at 6508 ft and gas came to the surface in 32 minutes. Flowing pressure was 100 lb. with bottom hole pressure of 1500 lb.

In Cheyenne County, Nebraska, Ohio Oil Company's No. 1 Reimer topped the Third Dakota at 4793 ft and on drillstem test between 4793-4803 ft the well made 2180 ft of light green paraffin base oil. The test is 10 miles north of Huntsman pool and some 10 miles northwest of Gurley.



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Western Geophysical International field party lined up before the Leaning Tower of Pisa in Italy. Six such crews operate for the company in Italy. M. A. Boccalery, vice president, is in charge of European activities of the company, aided by Thomas P. Maroney. Division offices are in Milan.

Italian Gas Strike Made

A new gas discovery has been made in the Croton Zone of the Calabria district in Italy. Gas was found at 500 meters. It was reported that an application will be made to the government from the chemical industry for permission to exploit these resources.

Rocky Mountain Drilling Is Up 66 Per Cent in 1951

In the Rocky Mountains about 66 per cent more exploratory wells were drilled during the first 6 months this year than in the same period last year, according to Petroleum Information, statistical firm. At the end of June this year, 146 exploratory wells had been drilled in the region, the report said, with depths totaling 729,913 ft, compared with 354,840 ft in the like 1950 period.

Colorado led the region with 49 attempts, but Wyoming led in discoveries with 7 producers out of 45 completions. The Denver-Julesburg basin led all principal areas in exploratory drilling, accounting for all the Colorado wildcats, plus 28 drilled on the eastern side in western Nebraska. Ten new pools have been discovered in this basin out of the 77 wildcats drilled to July 1, the report disclosed.

Continental Oil Completes Important Texas Discovery

Continental Oil Company has completed what it believes is a major oil discovery at its No. 1-A in Crockett County, Texas. The Shannon Ranch well is about 6 miles northeast of the Todd Ranch field, and 15 miles northwest of Ozona, Texas.

The well is being completed at a depth of 7236 ft after a third drillstem test from 7185 to 7236 ft, having previously showed oil from 7100 to 7150 ft and from 7151 to 7181 ft. The latest test had gas in 7 minutes, mud in 17 minutes, and oil in 22 minutes, and in the next hour 60 bbl of 40 gravity oil flowed through a ½-in. choke.

Cities Service Reports New Texas Oil Area

A new producing area for Andrews County, Texas, has been announced by Cities Service Oil Company (Delaware) and Sinclair Oil and Gas Company in the completion of their Reed B No. 1 wildcat. The wildcat was completed through perforations in the Pennsylvanian from 9133 to 9138 ft for a Texas Railroad Commission potential of 483 bbls of 38.4 gravity oil per day. Production tests were through half-inch choke.

The wildcat is little more than a mile southwest of a small Devonian producer and approximately 3 miles east of the Shafter Lake field, which produces from the Wolfcamp, Devonian and Ellenberger formations.

Exploratory Well Begun Off of Mexico by CIMA

The commencement of an exploratory well on the Tecominoacan structure in the Tehuantepec Isthmus area of Mexico was announced by Ralph K. Davies, president of American Independent Oil Company. The drilling operations will be carried on by an associated organization, Mexican American Independent Company, known in Mexico as CIMA, which recently reported an important oil discovery at Rabon Grande, on the coast near the city of Coatzacoalcos, Mexico.

Tecominoacan is some 55 miles to the east and inland from Rabon Grande and is regarded as an area of considerable promise. Seismic survey work has indicated the existence of a structure of large areal extent. The location selected for CIMA's first test well is in a region where heavy jungle growth and frequent tropical storms impose unusual transportation and operating problems.

New Oil Discovery Made In Williston Basin, Montana

One of the most important discoveries of late is the Shell Oil Company wildcat oil well in northeastern Montana. Situated in the Williston Basin, which covers more than 70,000,000 acres in the Dakotas, eastern Montana, and southeastern Sasketchewan, and Manitoba, the new well is in northwest Dawson County.

S. F. Bowlby, Shell's vice president reported that a 40 minute drillstem test was made between the depth 7183 and 7253 ft and well flowed high gravity oil at a substantial rate.

It is the first well to show commercial production in the Montana part of the Williston Basin. The Shell discovery is about 100 miles southwest of the Amerada Petroleum Company's well in North Dakota, which early in April produced oil from 11,000 ft.

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Service by seaplane is a unique feature of the Donovan Boat Supplies Company of New Orleans, which sells and services Chrysler marine and industrial engines. Operators in the remote and almost inaccessible regions of the lower Mississippi Delta and the Louisiana Gulf Coast have had the advantage of this seaplane service. With air delivery of service and parts available, operators have far greater control over costly "down-time." Many of the oil companies now drilling in the Gulf of Mexico have also used "service by seaplane."

Lion Makes New Kansas Oil Field Discovery

Lion Oil Company has discovered a new oil field in Ellis County, Kansas. The successful wildcat well is known as the Herl No. 1, but the field has not been officially named. It is producing 15 bbl per hour from the Arbuckle formation, and at last reports tests as to potential were not complete.

Mississippian Zone Hit

In Archer County, Texas, L. T. Burns has opened a Mississippian zone oil pool at his No. 1-A First National Bank. The new well gaged 548.96 bbl of 44 gravity oil a day from open hole at 5250-5324 ft. Gas oil ratio was 640 to 1. The Mississippian was topped at 5246 ft.

Cuban Survey Indicates Oil

The Cuban-Venezuelan Oil Voting Trust has reported a geophysical survey of promising areas within a 16,000,000 acre concession on the south coast of Cuba. Surveys of the south coast area in general during the last two years have indicated extensive sedimentary formations.

Large Texas Gas Well

A new gas well, which flowed 53,000,000 cu ft of gas a day at 1800 lb normal pressure, has been brought in North Neuces County, Texas, 5 miles north of King Richard field. Driller of the new well is Panhandle Producing and Refining Company. Gas flowed from a depth of about 5200 ft.

Large Gas Well Drilled In Southeast Alberta

A sizable flow of natural gas has been struck in the Bow Island sand at the Pakowki Lake-Manyberries area of southeast Alberta. It is the New British Dominion Oil Company, Ltd., and Mid-Continent Oil and Gas Company, Ltd., well, Etzikom No. 1, situated around 35 miles north of the Montana border. The well hit 13 ft of continuous highly porous sand in the Bow Island interval 2227-2240 ft. Fifteen minute drillstem test through a 3/8-in. choke gave a flow of natural gas to the surface immediately, with maximum rate 3,310,000 cu ft daily. Flowing pressure was 750 psi.

Oklahoma Well Complete

Shell Oil Company has completed its No. 1 Mikles in Beckham County, Oklahoma, for a flow of 381 bbl of 61.2 gravity condensate in 24 hours, through a 22-64-in. choke. Gas-oil ratio was 6414 to 1. Production is from perforations between 9716-22 ft, 9734-44 ft, and 9842-64 ft. Plugged back depth is 10,036 ft.

New Well Brought In Near Spindletop Field

About 1½ miles from Spindletop production in Jefferson County, Texas, a new gas-condensate well has been completed by Meredith, Clegg and Hunt. The new well is the No. 1 Ed Prather, which was completed to flow 114,700,000 ft of gas daily, open flow, plus 220 bbl condensate, from 8,076-80 ft. Shut-in pressure was 4970 lb.

New Spraberry Pool Given Texas County

Cities Service Oil Company (Delaware) and Continental Oil Company have given Upton County, Texas, another Spraberry pool in the completion of their University AM No. 1 wildcat. The well was dry in the Ellenberger and was completed for a Texas Railroad Commission potential of 103 bbl of oil daily from perforations in the Spraberry from 7088 to 7120 ft. Nearest Spraberry production is in the Benedum pool, about seven miles to the north of the University AM discovery.

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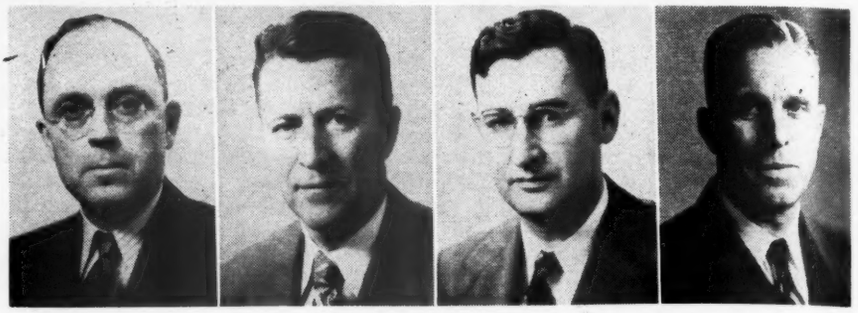
Chester F. Dolley, president of Atlantic Oil Company, was elected chairman of the Conservation Committee of California Oil Producers.

Other officers elected were: First vice chairman, **M. T. Miller,** of Standard Oil Company of California; second vice chairman, **J. L. Stephens,** of Chanslor-Canfield Midway Oil Company; and **L. W. Chasteen,** of Union Oil Company of California.

William S. Hill, has been promoted to district petroleum engineer of Union Producing Company's Houston, Texas district. Prior to his promotion, Hill was a petroleum engineer in Union Producing's Beeville district.

A graduate of the University of Texas, Hill joined Union Producing in the Shreveport general offices in 1941.

J. W. Hudson has been appointed general superintendent of Deep Rock Oil Corporation's crude oil production. Hudson fills the position vacated when Carl A. Houy was promoted to vice president in charge of the production division. Hudson received his B.S. degree in petroleum engineering from the University of Texas. After serving four years with the U. S. Navy, he joined Republic Natural Gas Company in 1945 as district engineer. Previously he had worked for Humble.



L. F. Athy | J. A. Culbertson | H. R. Prescott | S. K. Clark

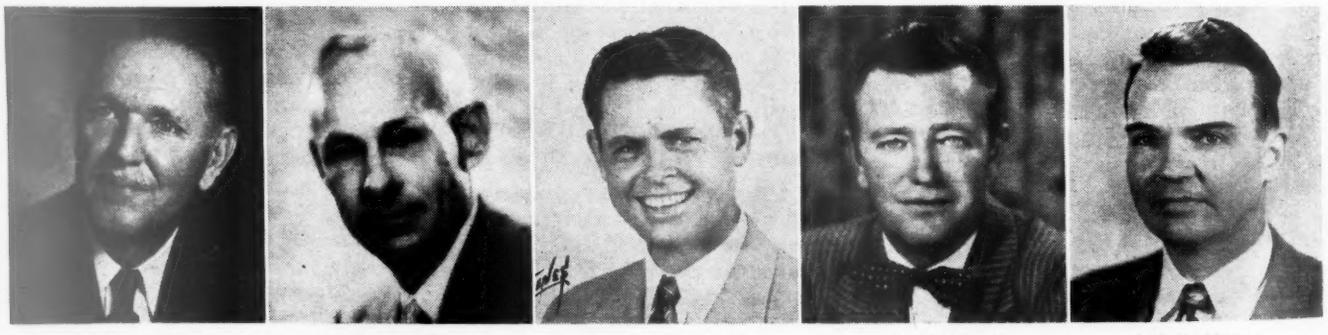
L. F. Athy, manager of Continental Oil Company's geophysical department, has been promoted to manager of the exploration department. **J. A. Culbertson,** chief geologist, was promoted to assistant manager of the exploration department, retaining his position as manager of the geological section. **H. R. Prescott,** assistant manager of the geophysical department, has been promoted to manager of the geophysical section.

Athy, who received his Ph.D. degree in geology from the University of Chicago, has been associated with Continental for more than 26 years. He joined the company as a geologist in 1925 in Ponca City, Oklahoma.

Culbertson received his Ph.D. degree in geology from the University of Illinois and joined Continental in 1933. Rising to division geologist in the Houston division, he was named chief geologist in 1949.

Prescott, who received his B.S. degree in engineering from the University of Kansas, joined Continental as an engineer in 1928. He became assistant manager of the geophysical department in 1949.

It was announced simultaneously that **S. K. Clark,** coordinator of exploration activities, has been promoted to the position of manager of the newly created royalty department. Clark, who received his B.S. degree in engineering from the University of Nebraska, joined Continental as a geologist in Ponca City in 1924. He had served as chairman of the exploration committee before becoming exploration coordinator.



O. S. Petty | P. J. Rudolph | W. L. Crawford | V. A. Petty, Jr. | W. L. Moore

O. Scott Petty was made chairman of the board of Petty Geophysical Engineering Company. For the first time in its 26-year history Petty Engineering has elected officers and directors outside of the Petty family. **P. J. Rudolph,** was named president and general manager; **Weldon L. Crawford,** executive vice president and treasurer; **Van A. Petty, Jr.,** vice president and secretary, and **W. Lee Moore,** vice president.

Scott Petty has been president of the company since its formation in 1925. The company was founded in 1925 by Dabney E. O. Scott, and the late Van A. Petty, brothers, with the assistance of their father, the late V. A. Petty, Sr. Contrary to previous policies, key employees approved by the board will be allowed to own stock.

Rudolph, new president, joined Petty in 1932, and was named general manager in 1944. He is a graduate of the University of Texas. Crawford joined Petty in 1933, and since that time has seen foreign service and has supervised geophysical work all over the U. S. and abroad. He was made assistant manager in 1944. He attended Texas A. & M. and the University.

Van A. Petty, Jr., first joined the company in 1934, leaving later to attend the University of Texas. He rejoined the company in 1942 and was elected vice president. Moore has been in charge of the Petty's Tulsa office for the last six years, having joined the company in 1930. He is a graduate of the University of Texas. In addition to the above named officers, **Arthur L. Lay** will serve as a director.

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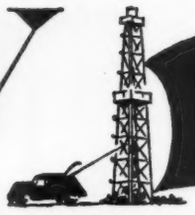

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7. Save hundreds of feet of valuable drill pipe, casing, and tubing.
8. Permit your well to be completed in less time with less trouble.
9. Give you greater production at less cost.

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Here are the four members of the McCULLOUGH JET FAMILY and what each one will do for you:

McCULLOUGH JET CASING CUTTER

Slashes Rig Time. This jet tool reduces to a FEW MINUTES, a casing cutting job that would normally take from 10 hours to several days! This is accomplished by eliminating the need of a rotary table and running in and out of the hole with drill pipe or tubing. When fired, the casing is severed in a clean, straight line without damage to an outside string. Accepted as standard practice by major oil companies, it is an ideal companion tool for the McCullough Magna-Tector—used first to locate the stuck point.

McCULLOUGH JET BACK-OFF TOOL

Permits Recovery of Stuck Pipe Without Cutting. Instead of cutting, the jet charge in this tool is so controlled that it LOOSENS the box of a tool joint or coupling, without damage in most cases, permitting it to be freely unscrewed. Only the exact joint to be unscrewed is affected. This tool is also an ideal companion tool for the McCullough Magna-Tector.

McCULLOUGH BOTTOM HOLE JET CUTTER

Fragmentizes Obstructions to Progress. Large pieces of junk in the bottom of the well that are too large to be recovered or too difficult to be recovered are instantly broken up into small pieces with this jet tool. Articles such as: rock bits, slips, reamer bodies; etc., are fragmentized so that they can be recovered by usual methods.

McCULLOUGH GLASS JET PERFORATORS

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To obtain more information on products advertised see page E-35

▸ **Bird G. Swan,** formerly chief geophysicist for Continental Oil Company at Ponca City, Oklahoma, was recently named assistant manager of Continental's geophysical section. A graduate of Oklahoma University, Swan joined Continental in 1932. In 1948 he became geophysical superintendent of the company.

▸ **Vernon Blain,** John Drilling Company, has transferred from Hobbs, New Mexico to Odessa, Texas. He is superintendent of drilling for the company.

▸ **Ed Harrison,** geologist and geophysicist for the California Company, recently joined Sunray Oil Corporation as geologist.

Officers of the newly formed Sunbeam Oil Company, Oklahoma City, Oklahoma. Left to right, Vernon Howell, vice president; G. B. Howell, president; Walter Duncan, Jr., secretary-treasurer, and Robert J. Beams, vice president and chief geologist.

▸ **Thomas Brownfield** was named vice president in charge of operations for The Carter Oil Company. He will be in charge of all the company's producing, manufacturing, and marketing operations. Exploration activities will continue under H. F. Moses, vice president.

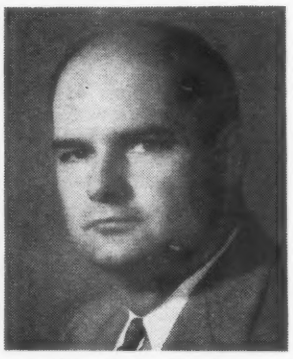
Brownfield attended the Universities of Tulsa and Oklahoma. He began work for Carter as a clerk in the oil runs department in 1927. Later he transferred to the scouting division, and after various promotions became executive assistant in the producing department of Standard Oil Company (New Jersey) in New York. He returned to Carter in Tulsa in 1946, serving as secretary of the company. He was elected to the Carter board of directors in 1948.

G. Dawson Priestman, assistant manager of the economics department, will succeed Brownfield as department head.

The board of directors also elected **John M. Sprague** to the position of comptroller of the company, succeeding **L. S. Collins,** who will remain as director in charge of Carter's accounting and allied departments.

Harry E. Estes

E. T. Heck



Ben S. Smith, Jr.

▸ **Harry E. Estes,** sales coordinator of the A-1 Bit and Tool Company, has been elected executive secretary of the NOMADS National Board of Regents. Estes received the unanimous approval of the board to succeed **Harold M. Cosgrove,** who is retiring.

Estes has been executive secretary of the Houston Chapter of NOMADS for the past eight years, and will continue in that capacity.

▸ **E. T. Heck** has accepted a position in charge of geology and engineering for the Minard Run Oil Company. He previously occupied a similar post with the production division of Quaker State Oil Refining Corporation at Bradford, Pennsylvania. Heck is a graduate of West Virginia University. He was associated with the West Virginia Geological Survey from 1935 until 1943. He is the author of numerous papers dealing with petroleum geology and petroleum engineering.

▸ **Ben S. Smith, Jr.,** has been named director of Industrial Relations for Lion Oil Company, T. M. Martin, president, announced. He replaces John W. B. Foringer, who resigned.

Smith received his education at Metropolitan Business School in Dallas and Rice Institute of Houston, Texas. He became associated with Lion Oil in April, 1937.

▸ **W. Baxter Boyd,** formerly area geologist of the Fort Worth area for Continental Oil Company, has been appointed manager of exploration for Republic Natural Gas Company, Dallas, Texas. Boyd, a graduate from the University of Oklahoma, immediately began his career in the petroleum industry with the firm of W. H. Atkinson, Oklahoma City. Boyd then joined Continental Oil Company as area geologist.

Republic has also appointed **J. H. Hester,** formerly drilling superintendent of the company, as general superintendent. **C. C. Book,** district superintendent for Republic in Oklahoma, has been transferred to the Dallas office, where he will assume duties as assistant to Hester.

▸ **Chester L. Doyle** has been advanced to assistant chief petroleum engineer in the exploration department of the General Petroleum Corporation. His headquarters will be in company offices at Vernon, California. A native of Santa Maria, Doyle came with General Petroleum in 1939 upon his graduation from the University of California. He formerly was senior petroleum engineer in the company's San Joaquin offices.

▸ **J. S. Welboan, Jr.,** has been promoted to assistant to division manager of the geophysical division, producing department of The Texas Company. Welboan, who will be in the division office at Houston, was graduated from the University of Oklahoma with the B. S. degree in petroleum engineering. Shortly afterward he was employed by the company. He was named supervisor of geophysical operations in the West Texas division of the producing department, with headquarters in Fort Worth, on September 1, 1949.

▸ **J. T. Dickerson** senior representative for Shell Oil Company in Midland, Texas, has been named vice president of the company. Other senior representatives named vice presidents are: **W. A. Alexander,** Tulsa, Oklahoma; **Bouwe Dykstra,** New Orleans, Louisiana, and **E. G. Robinson,** Calgary, Canada.

Shell has also announced that a new Technical Services Group has been formed with **Dr. Harold Gershinowitz** as head. Gershinowitz has also been named vice president. The Group will provide technical advice and assistance for the company's exploration and production activities throughout North America. Assisting Dr. Gershinowitz are **Dr. Noyes D. Smith, Jr.,** who will be research manager in charge of Shell's exploration and production research laboratory in Houston, and **J. Chalmers,** who will be technical services manager.

Also announced at the same time was the promotion and transfer to New York from Houston of **R. W. Bond,** who becomes manager, head office production, and **F. A. Nelson,** named manager, head office exploration. They will assist A. J. Galloway, Shell's vice president in charge of all exploration and production activities.

▸ **Jeff Thomas** has been named sales manager of the Indian Drilling Mud Company, Oklahoma City. Thomas has been active in the Oklahoma City area since 1941 when he joined Black, Sivalls and Bryson. He is a former student of the Oklahoma University. His territory will cover the entire Mid-Continent area served by the Indiana Drilling Mud Company.

Jeff Thomas

Donald G. O'Brien R. D. Atchley

▸ **Raymond D. Atchley** has been elected vice president in charge of engineering at Midwestern Geophysical Company, Tulsa, Oklahoma. Atchley has been employed at MIT for the last five years in the design of hydraulic servo components and instruments for the MIT three-axis flight simulator, as well as the missile program of "Project Meteor."

Donald G. O'Brien, has been appointed chief engineer by Midwestern Geophysical. For the last two years, O'Brien has been project engineer for the MIT single-axis high-speed flight simulator, and was responsible for design and testing of it.

▸ **J. Edgar Heston** of New York City has been appointed manager of oil production of Petroleum Advisers, Inc., a Cities Service Company affiliate. Heston succeeds **Warren A. Sinsheimer,** recently appointed petroleum economics coordinator for the company.

Heston was graduated from Oklahoma University in 1931. Since that time he has filled various key positions in the geological and oil production departments of Cities Service companies. From 1941 to 1945, Heston served as assistant director of production of the Petroleum Administration for War. Upon the completion of this service, he became assistant manager of the oil production department of Petroleum Advisers, Inc.

Dallas-Fort Worth Nomads Golf Tournament
Among winners at the Nomads golf tournament in Fort Worth were those above: Back row, (all winners) Dan Bailey, Continental Supply Company; Johnny Everroad, Mid-Continent Cummins Export Corporation; Joe Roach, Hughes Tool Company; Mac Hiltpold, Buda Engine Company; Jack Mussler, Continental Supply; Seated, (Noiman Smith, Byers Drilling Company); R. G. Williams, Seaboard Oil Company (winner of trophy); Jack Davis, Continental Supply; Jack Collins, Sun Oil Company; Seated in front: J. A. Kelly, Reed Roller Bit Company (winner of consolation prize).

At left, W. K. Daggett, Welex Jet Services, Inc.; G. J. Fix, Jr., Geo. J. Fix Company; W. W. Klemme, Chain Belt Company; Abbott Sparks, The Petroleum Engineer.

Frank Jocobson

William Hurst

Mose D. Hodges

Frank Jacobson is the new president of Lucerne Corporation, Dallas, Texas. He formerly was vice president of Buffalo Oil Company in Dallas.

R. L. Boulware has been promoted from party chief to supervisor, National Geophysical Company of Canada, Ltd. **Corby Hart** was transferred from National Geophysical Company of Canada, Ltd., and promoted to supervisor in National Geophysical Company, Dallas.

E. L. Campbell has been transferred to Midland, Texas, and promoted to supervisor in charge of West Texas operations. **J. H. Frazer** was promoted to supervisor in National Geophysical Company of Canada, Ltd.

M. E. Michael, development foreman of Phillips Petroleum Company's Gulf Coast production division, has been appointed district superintendent at Beaumont, Texas, succeeding **H. M. Bell,** who has resigned, according to an announcement by C. P. Dimit, vice president, production department.

William G. Green has resigned as president and director of Well Surveys, Incorporated, pioneer radioactivity well logging research and development company. Green resigned to devote his entire time to his other business interests. **Charles E. Duller,** vice president, has been elected a director of the company and will direct the operations of Well Surveys, Inc.

William Hurst of Houston, Texas became a partner and **Mose D. Hodges** an associate partner with E. O. Bennett, James O. Lewis, and David G. Hawthorn in the firm of Petroleum Consultants, Mellie Esperson Building, Houston, recently.

Hurst was graduated from Massachusetts Institute of Technology in 1929, and joined Humble Oil and Refining soon after graduation. In 1943 he joined Shell Oil as a reservoir engineer, and prior to joining Petroleum Consultants, was engaged in private practice in reservoir engineering.

Hodges is a graduate of Rice Institute. His first employment was with Marland Oil and Continental Oil Companies. In 1946 he joined Petroleum Consultants as a petroleum engineer.

Mark L. Terry, assistant division manager of the Oklahoma division of Texas Company, has been named to succeed **M. J. Heald** as division manager, Oklahoma division, producing department, retired. Heald will be available to the company only in a consulting capacity. He joined The Texas Production Company, Texas Company subsidiary, in 1927. In 1929 he was named district superintendent of the North Central Texas division for The Texas Company; became division manager, Oklahoma division in 1946.

Terry, a graduate of the University of Missouri School of Mines, worked for the Josey Oil Company when Texas bought that company in 1929.

New officers of Halliburton Oil Well Cementing Company are R. G. Kelly, left, and G. D. McEnroe. See story at right.

H. H. Bradfield, now district geologist at Wichita Falls, Texas, West Texas division of the producing department, The Texas Company, has been promoted to senior geologist on the manager's staff of the producing department with headquarters at Houston. He will be succeeded as district geologist by **Harvard Giddings,** now a geologist in the Wichita Falls district office.

Bradfield received the A.B. and M.A. degrees in geology at the University of Indiana. After working for Shell Oil Company for two years, he returned to the University and was awarded the Ph.D. degree in geology. He joined The Texas Company in the Wichita Falls office as a junior geologist in 1935. Giddings studied at the University of Wisconsin. He was employed by The Texas Company as a surface geologist in 1937.

Jesse A. Rogers has been promoted to senior geologist in the division office at Fort Worth, and will be transferred from Midland where he has been district geologist. **Robert H. Martin,** district geologist at Abilene, is being moved to Midland to replace Rogers. **N. D. Raman,** geologist at Fort Worth, is being advanced to succeed Martin at Abilene.

A graduate of Texas Tech, at Lubbock, where he received the B.A. degree and the M.A. degree in geology. Rogers was employed by The Texas Company as a junior geologist at Wichita Falls in 1936.

Martin, who was graduated from Miami (Ohio) University, joined the company in 1942.

After graduating with a B. S. degree in geology from the University of Oklahoma in 1942, Raman worked as a field geologist for the U. S. Geological Survey. He began his service with The Texas Company as a West Texas division geologist in 1946.

R. G. Kelly, has been named regional vice president of Halliburton Oil Well Cementing Company, and **G. D. McEnroe,** new assistant treasurer. Kelly joined Halliburton in 1930 at Odessa, Texas. Assignments followed at Hobbs, New Mexico; Midland, Texas; Shreveport, Louisiana, where he became manager of Halliburton's North Louisiana division; Midland, as West Texas-New Mexico division manager; and Duncan, Oklahoma, Halliburton's home office, as regional manager for the central region. All other Halliburton officers were re-elected.

McEnroe began his Halliburton career in 1940 as a tax accountant. Successive promotions brought him to tax department supervisor and to his new post as assistant treasurer.

Both Kelly and McEnroe continue to maintain headquarters at Duncan.

L. H. Byrd, Humble Oil and Refining Company, has been transferred to the California district, Gulf Coast division from London district, East Texas division.

J. T. Knauth, assistant district superintendent, was transferred from the Friendswood district to the Lovell Lake district, Gulf Coast division. **O. L. Fielder,** toolpusher, Southwest Texas division, moved to the Sugar Valley district, Gulf Coast division.

Toolpusher **William I. Boynton,** Hawkins district, East Texas division, was transferred to the Winters district, North Texas division.

H. V. Wait, district petroleum engineer, moved from the Galveston Bay district, Gulf Coast division, to the Louisiana division office as supervising petroleum engineer.

William F. Shelton, petroleum engineer, Grand Isle district, Gulf Coast division, transferred to the economics and statistics division, Houston office, for work as senior petroleum engineer.

Jack M. Shepherd, supervising petroleum engineer, was promoted to assistant district superintendent, London district, East Texas division. **O. B. Moon,** gangpusher, was promoted to farm boss, Gladewater district, East Texas division. **George Ford,** gangpusher, was promoted to farm boss, London district, East Texas division.

H. C. Bright, driller, was promoted to tool pusher, Willamar district, Southwest Texas division.

Jim Stephenson, tool pusher, was promoted to assistant district superintendent, Friendswood district, Gulf Coast division.

J. R. McWilliams, executive vice president and director of The Carter Oil Company, affiliate of Standard Oil Company (New Jersey), has assumed the post of deputy coordinator of Jersey's worldwide producing activities. McWilliams, who is stationed in the New York office, has resigned his position with Carter Oil.

McWilliams has had broad experience in producing operations since graduating from the University of Michigan in 1919. After brief service in the armed forces he spent the next 15 years in engineering and conservation work with oil companies and state agencies and joined the Carter organization in 1934. After a year's leave of absence in 1945, during which time he served as director of the production division of the Petroleum Administration for War, he returned to Carter's headquarters in Tulsa and subsequently was made executive vice president. McWilliams had also served as a vice president and director of Standard Oil Company (Louisiana).

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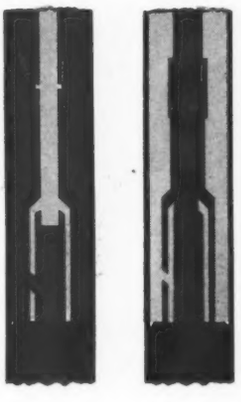

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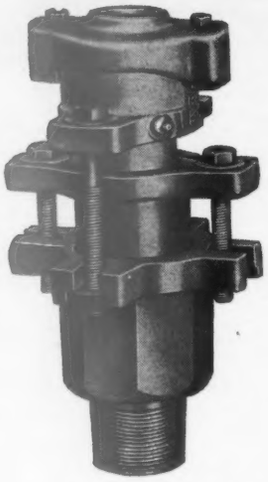

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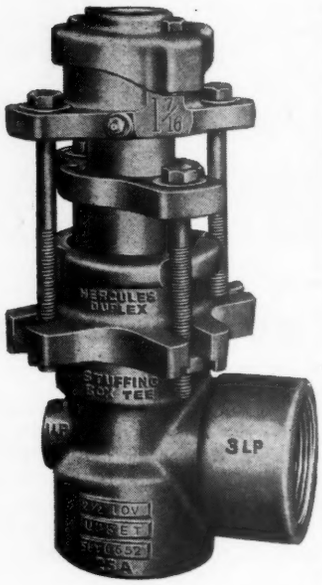

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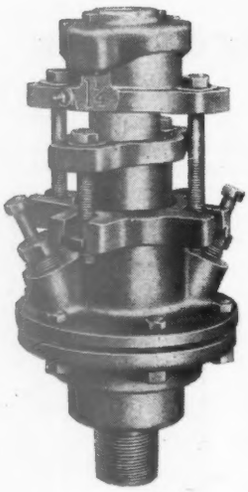

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R. J. Pigott

B. E. Groenewold

▸ **Reginald J. S. Pigott,** director of the engineering division of Gulf Research and Development Company of Pittsburgh, a subsidiary of **Gulf Oil Corporation,** has been nominated president of The American Society of Mechanical Engineers. Pigott heads a slate of new ASME nominees, including four regional vice presidents and two directors-at-large, submitted by the society's nominating committee. As only one name is presented for each office, nomination is tantamount to election. Election will take place in the fall by letter ballot of the membership. Pigott will succeed **J. Calvin Brown,** of Los Angeles, engineer and patent attorney.

Director of engineering research of Gulf Research and Development Company since 1929, Pigott's professional record includes 11 years in the design, construction, and operation of central steam power stations; 7 years in designing and constructing power and industrial plants; 5 years in metal manufactures, and 18 years in petroleum engineering research.

▸ **B. E. Groenewold** has been named manager, **Bruce Harp,** assistant manager, and **C. J. Matthews,** Rocky Mountain drilling superintendent of Exploration Drilling Company. Groenewold a graduate of MIT. has spent over 26 years in the Mid-Continent area oil industry, having been with Cities Service, The National Supply Company, and Bethlehem Supply Company, prior to joining Exploration Drilling. He has served as cnief engineer and as assistant manager.

Harp will be stationed at Midland, Texas, and prior to his advancement was drilling superintendent for the Mid-Continent area. Prior to joining Exploration, he had wide experience drilling and pushing tools in Louisiana, Gulf Coast, Oklahoma, New Mexico, and East and West Texas.

Matthews is stationed at Riverton, Wyoming. Beginning early in Texas, he has had a variety of experience in that state, Oklahoma, and throughout the Rocky Mountain Area.

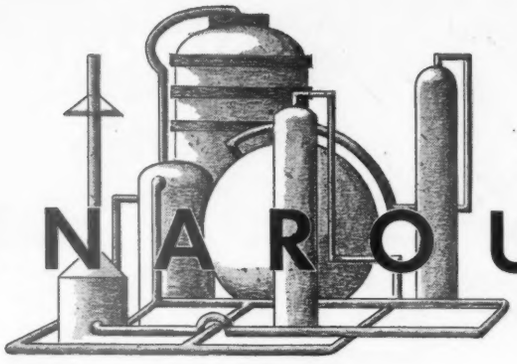
▸ **R. G. Greene** has been appointed manager of exploration for Union Oil Company's western area, embracing the Pacific Coast, Rocky Mountain and Canadian division. He has been manager of exploration in the Pacific Coast division since 1949.

John R. Sloat succeeds Greene as manager of exploration for the Pacific Coast division. **Lon D. Cartwright** will continue in charge of Union's exploration activities in the Gulf and West Texas divisions as well as unassigned and foreign areas. He will also serve as liaison with United Geophysical Company.

Greene was educated as a geologist at Cornell and Stanford. He joined Union Oil in 1929 for exploration work in Venezuela. From 1937 to 1943 he was employed by the Union Pacific railroad. In 1943 he rejoined Union Oil, and in 1949 was appointed manager of exploration for the Pacific coast division.

Sloat was graduated from MIT in 1934. For three years he served as a geophysical party chief in Texas, Kansas, Colorado, and California. He joined Union Oil in 1938.

THE TURNAROUND



Petrochemicals and Synthetic Fuels

It appears to be entirely accurate to say that in no field of chemical endeavor, past or present has any movement traveled so fast as that of the application of petroleum and natural gas hydrocarbons to organic chemical synthesis.

Shell Chemical interests are increasing by 50 per cent the output capacity of synthetic glycerine — product from "fats," which never saw a pig or steer or sheep or any member of the animal kingdom. Same outfit is building a new unit for benzene hydroforming at its plant near Houston, Texas. Ditto for duodecyl benzene, a detergent intermediate, in connection with its Wood River, Illinois, refinery. All these use some byproduct of refining, usually an olefin, and applied in literally numberless ways to the synthesis of industrial and commercial products, also without number.

Critically short benzene is one of the nation's headaches; gas makers of Honolulu come up with a steady stream of benzene, byproduct from the cracking of petroleum gas oil to enrich manufactured fuel gas; 300,000 gal taken by tanker to Los Angeles and by truck to Stauffer Chemical's chlorination plant in Nevada to make insecticides DDT and BHC (latter is benzene hydrochloride), to help save our cotton and other farm crops.

Solvay Process, staid but progressive chemical makers, has yielded to progress in another matter. Boosting its ammonia capacity by another 100,000 annual tons—it has built 80,000 tons since the War—up to circa 450,000 tons, Solvay reportedly is deserting the hydrogen-from-watergas-from-coal source of H_2 for synthesis purposes and going over to natural gas.

And Chemstrand Corporation takes a nylon manufacturing license from duPont to synthesize that famous product, has decided on "just North of Pensacola, Florida," as site, will begin construction in a short time. Plant cost, $75 million; capacity unannounced. Raw material is also not yet announced but rumor says looking at cyclohexane as the likely "winner." The drawback is a source of high purity cyclohexane; there's a job for our vaunted refinery distillers, via azeotropes or otherwise to guarantee a sufficient supply at a suitable price.

Another butyl or "cold" rubber plant being studied by Rubber Reserve with Borger, Texas, as likely site, Phillips as likely operator of it, a 40,000-ton per year unit; plenty isobutylene is the controlling factor in location.

Then Panhandle Eastern Pipeline contracts with National Distillers for a petrochemical factory in Illinois, operating on very rich gas from PE's pipe line, which can supply a billion cubic feet, initially to "strip" gas and make ethylene. Plant will have the largest yields of products per unit of gas processed of any in the field.

Nobody "bites" on Government bait to build coal hydrogenation facilities, even with 100 per cent tax writeoff. Socialist legislators want the government to build it.

Federal projects at Pittsburgh and in Missouri are publicizing much data, not convincing as to economics.

Coalman Pursglove says the country will begin reverting to coal in 1955, expects oil and gas to be 'in hot water' by 1957-60, when coal hydrogenation will begin. Coal will come of age in 20 years, he says, not die as has been predicted.—A.L.F.

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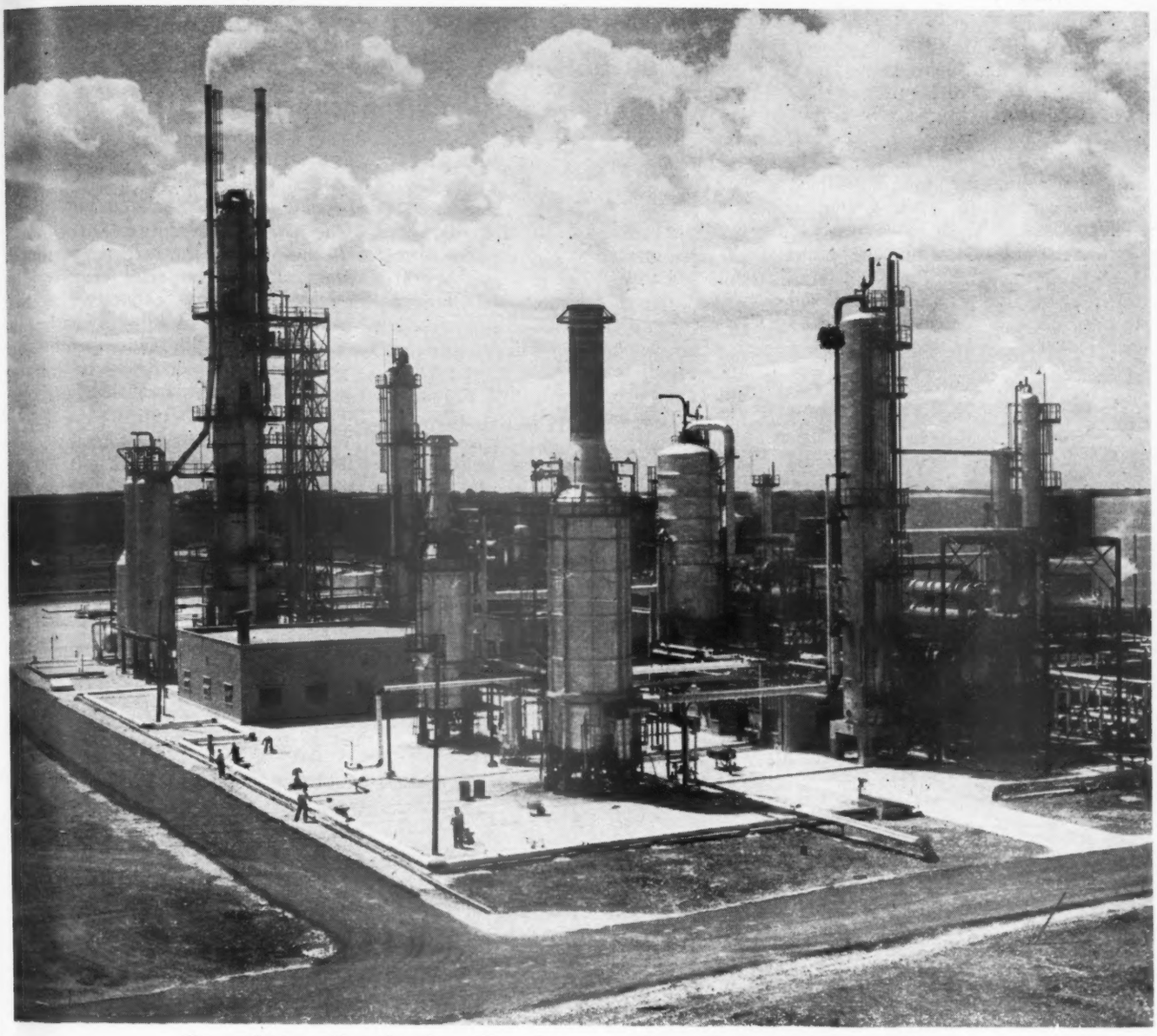


General view of crude pipe still and tower at Imperial Oil's Winnipeg refinery.

Winnipeg Refinery Begins Operations

HARRY CHAPIN PLUMMER

ENVIRONMENTAL and climatic factors pulled their weight in the original surveys, undertaken in 1948, for the building of a $10,000,000 petroleum refinery at Manitoba's capital, Winnipeg. It was completed and formally opened in June of this year. The resulting installations have taken the form of combination atmospheric and vacuum unit for crude processing plus fluid catalytic cracker and auxiliary equipment, with ample provision for future equipment as occasion may warrant. The productive capacity of the refinery was set at 10,800 bbl daily and that of the "cracker" at 3000 bbl per day, with complementary storage tank facilities accommodating 1,000,000 bbl.

Upward of half a thousand men were employed in the construction of Western Canada's new refinery, the property of Imperial Oil Limited. So well organized was the big job that only 13 months elapsed between letting of the contracts and the commencement of processing, which immediately followed the official opening. Among the distinguished figures of Canadian political, technological, and business life attending the dedica-

EXCLUSIVE

tion ceremonies were:

Hon. R. F. McWilliams, Lieut. Governor of Manitoba; Hon. D. L. Campbell, Premier of Manitoba; Hon. J. S. McDiarmid, Minister of Industry and Commerce; G. L. Stewart, president of Imperial Oil Ltd.; C. E. Simonite, acting mayor of Winnipeg, and Cromer Yeatts of the Canadian Kellogg Co. Ltd.

Now in full operation, the plant employs a staff of 175, most of them drawn from the Winnipeg area and trained specially for their jobs. Key men, however, have come from other Imperial refineries, so that advantage might be taken of their long specialized experience, essential to successful oil production. Keith Lewis, of Belmont, Nova Scotia, until lately superintendent of Imperial's Montreal East Refinery, and who joined the company in 1933, was appointed to head the Winnipeg operation in a like capacity.

The site is a 400-acre property on the east bank of the Red River, about 8½ miles north of the business center of Winnipeg. Provincial Premier D. L. Campbell, of Manitoba, officially presided at the beginning of construction and turned the first sod, operating a huge diesel-powered bulldozer. In a dedication address, he remarked:

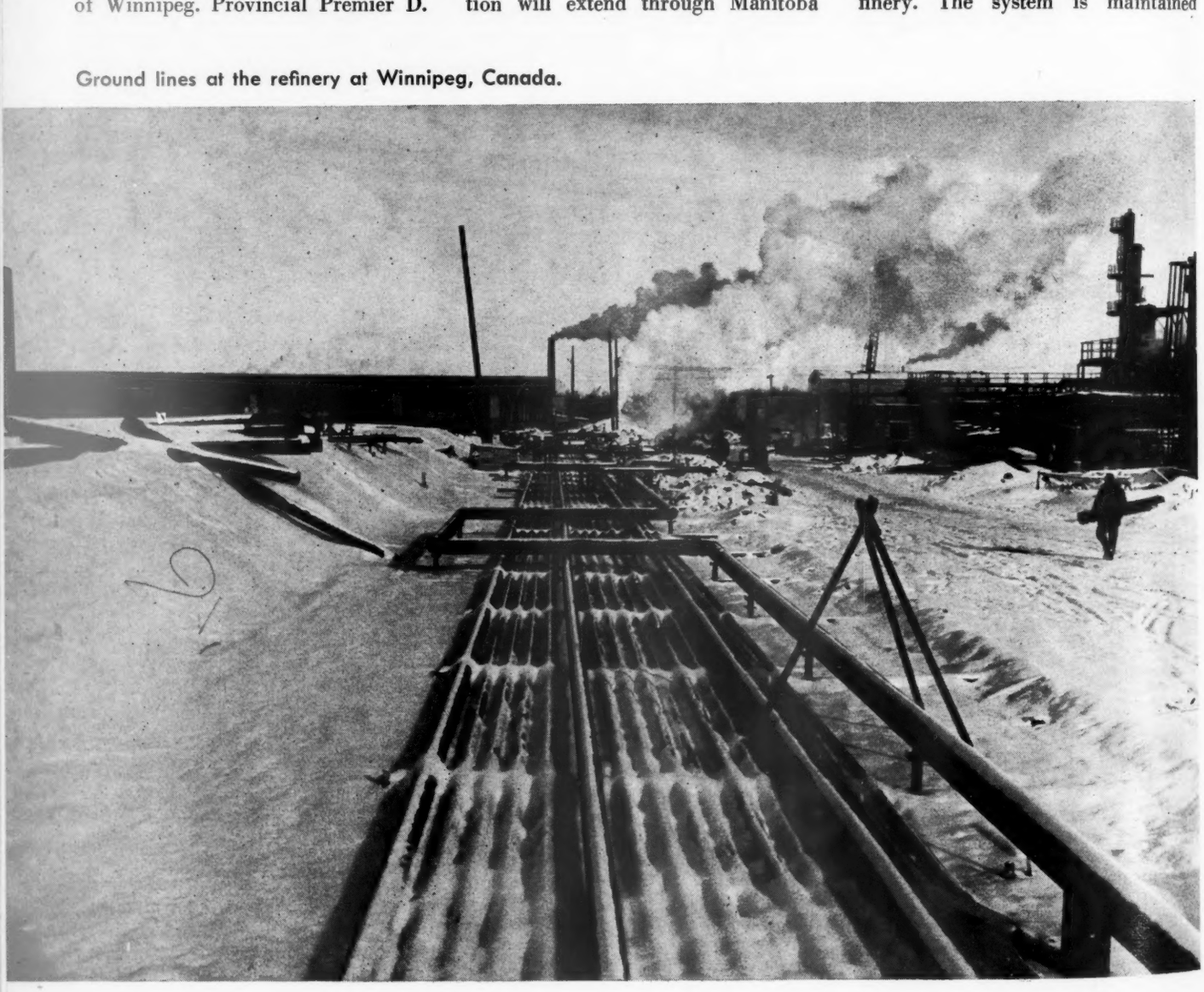
"This development will provide raw materials that will benefit the further industrial progress of this province. * * * This refinery, supporting and complementing all our national resources, will be a strong link in our economic chain."

The refinery is now supplied crude from the pipe line that Interprovincial Pipe Line Company Limited has built from Edmonton to the Great Lakes and that is to be transformed into high octane gasoline, diesel fuel, and kerosine and heating oils. Distribution will extend through Manitoba and parts of Northwestern Ontario. In announcing the formal opening of the refinery, Imperial stated: "Increased refinery capacity together with movement of Alberta crude eastward by pipe line will mean lower petroleum product prices in the area served by the new facilities."

The Interprovincial pipe line is tapped at Gretna, Manitoba, by a new 10-in. pipe line costing $2,500,000 and requiring one pumping-station, now at Gretna, adjacent to the station of the big trunk operation. Initial throughput to Winnipeg is about 14,000 bbl daily, with rated capacity of 30,000 bbl. In addition to the 75-mile operation, a 3½-mile, 8-in. take-off supplies another Winnipeg refinery. The system is maintained

Imperial Oil Company's new Canadian refinery of 10,000 bbl a day will process Edmonton crude — the catalytic cracking capacity is 3000 bbl a day

Ground lines at the refinery at Winnipeg, Canada.



under the ownership of the Winnipeg Pipe-Line Company Limited, an Imperial subsidiary newly organized.

The refinery consists of two main units together, with service units, facilities for employees, and other buildings. The first of the main units is the regular distillation plant, which takes in crude oil and turns out raw gasoline, kerosine, tractor, diesel, and stove and furnace fuels. It also provides the oil "feed stock" that goes on to the second big unit, the fluid catalytic cracking processor. Gases produced by the distillation and cracking processes will be separated in a gas recovery plant and some blended with the gasoline, to give quick starting properties. The raw light products turned out by the distillation and cracking units are further purified in a central treating plant before they are ready for the consumer.

The fluid catalytic cracking unit, of a new type, turns the feed stock into gasoline, which has a considerably higher octane rating than gasoline that comes from the still. Both main units also turn out heavy products such as bunker fuels and asphalts. The combination of two units is typical of the most modern refineries in the world.

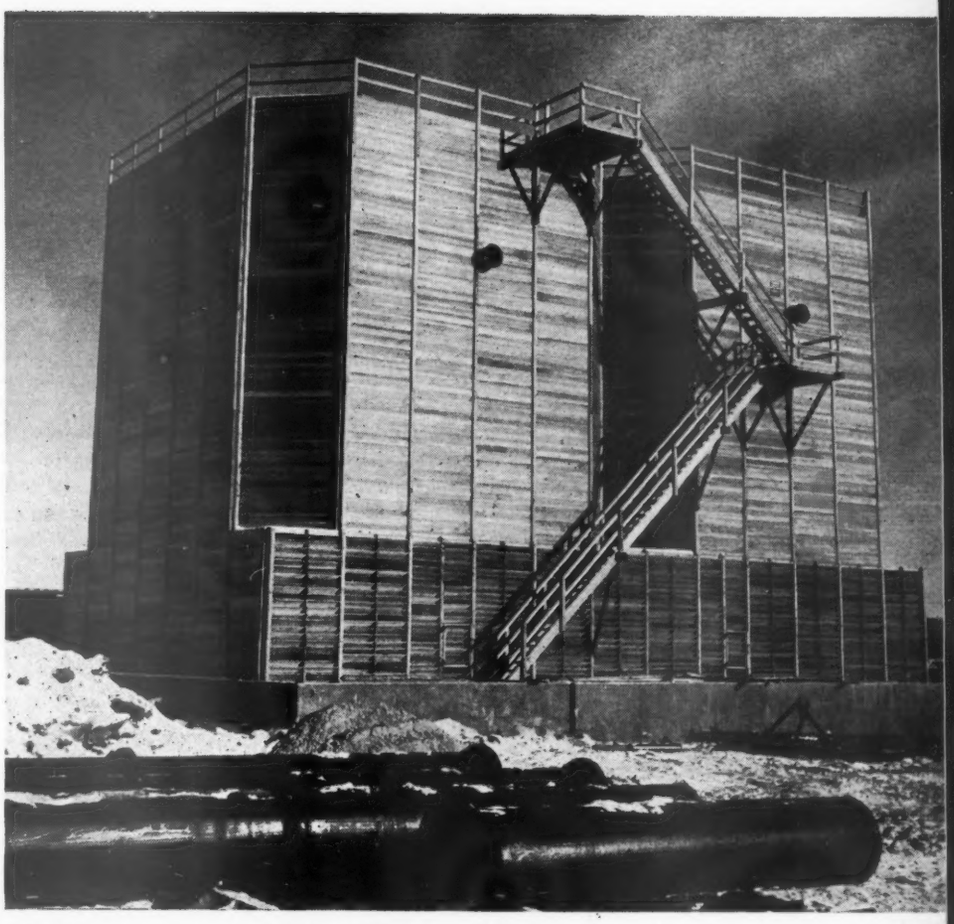
Such a refinery also has to have a steam plant, testing-laboratory, water pumphouse, small plant for adding tetra-ethyl-lead to gasolines, loading racks, an electrical sub-station, an office structure and tanks to hold crude and refined products.

The engineering work was carried out by Imperial's engineering and development division at Sarnia, Ontario, and by the Canadian Kellogg Company Limited, the latter of which is the general contractor, and by subcontractors in Winnipeg.

Manitoba formerly was dependent upon petroleum products imported from other areas principally from the East. Finished products were brought by tanker across the Great Lakes and transported to the prairie center by rail tank car. In some cases products were freighted from as far away as Montreal. Surveys were begun 3 years ago for the building of the refinery at Winnipeg, the capital city and major consuming market.

Process designs were begun on all of the operating equipment. Imperial's engineering and development division did the process design for the combination atmospheric and vacuum unit, treating facilities, and the utility buildings. The Universal Oil Products Company prepared the process design for the fluid catalytic cracking unit. Meanwhile a suitable site on the out-

PHOTOS BY IMPERIAL OIL



Cooling tower at Imperial's Winnipeg refinery.

A welder and assistant work on the desalting sphere.

skirts of Winnipeg was purchased. It is interesting to note that that property was once farmed by R. R. Taylor, grandfather, and S. Taylor, the father, of Vern Taylor of Imperial's crude oil producing department. It is perhaps symbolic that Vernon Taylor is one of the men who shares the credit for the Leduc discovery which, in turn, was a development leading up to the construction of the refinery at Winnipeg.

Invitations to bid were issued to contractors in November of 1949 and the contract was awarded to the Canadian Kellogg Company late in January, 1950.

The refinery has been designed to present an economical, compact layout. The processing units are all situated in one plot area and are operated as integrated units from a central control room. Provision has been made for the future installation of additional equipment adjacent to the present units. Flow of crude oil and products through the refinery has been arranged to minimize interconnecting piping. Crude tankage is located to one side of the processing units and product storage on the opposite side so that flow is in a straight line. Storage tankage will aggregate to 1,000,000 bbl. Piping throughout the storage areas was laid on sleepers at grade.

The refinery is served by spurs from the Canadian National Railway tracks, just to the north of the refinery, and from the Canadian Pacific Railway tracks bordering on the east. A loading rack capable of handling 30 tank cars at a time has been erected. A piece of the site fronting on the Henderson highway has been set aside for the use of the company's marketing department. Tank trucks are filled in that area.

The utility equipment (steam generators, cooling water pumps, compressed air supply and electrical substation) is concentrated in one area for maximum efficiency. An interesting feature of the utility building is that the steam boilers have been built outside with their firing aisles located inside the building. Steam generating capacity is 100,000 lb per hour.

Some of the earthen fire walls around the storage tanks will act as elevated roadways through the tankage areas. The reason for this is that in the event of fire the foam trucks would have to get through at all seasons of the year. Because of the severe climate, with heavy snowfall and high winds, the fire walls were converted to elevated roadways so that snow will blow off the roads into the tank lots and thus reduce the snow removal problem.

The office and technical buildings are of modern design with exterior finish similar to those erected at Imperial's Edmonton refinery. The combination warehouse, mechanical shops and lunch and locker-room building is of steel frame construction with a patented steel siding. Other buildings are of concrete block construction.

Cooling water for the process units is supplied by a closed circulation system with a cooling tower. Approximately 12,000,000 gallons pass through the circuit daily. Make-up water is pumped from the Red River. That system along with a Dorr circular oil-water separator was chosen as the most satisfactory solution of the dual problems of the silt and hardness of the Red River water and of avoiding pollution of the river by the refinery effluent. Drinking water is supplied from a well drilled to bedrock some 300 ft below the surface.

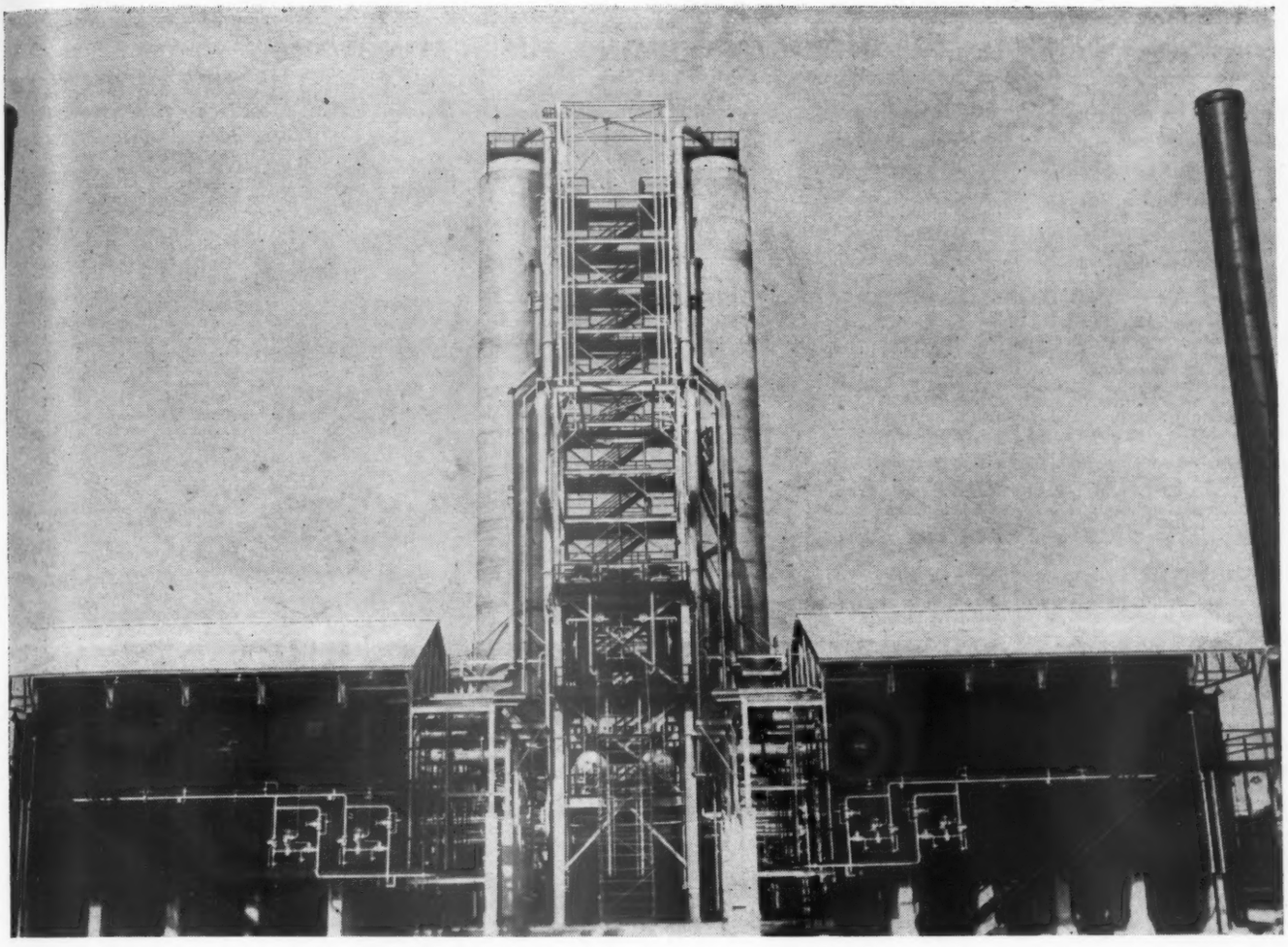
A feature of the design of the processing units is the arrangement of the vessels in relation to the pump houses. The fractionating towers, condensers, exchangers, etc., have been arranged on a center line parallel to the pump houses and close to them. This keeps interconnecting piping to a minimum and reduces the length of the pump suction lines. The whole processing area has been paved, thus permitting maximum utilization of motor-driven maintenance equipment.

Heaters for the combination atmospheric and vacuum distillation unit are of the vertical up-fired Petrochem design. The central treating plant handles both natural and cracked naphthas and middle distillates.

Construction of the refinery required 13,000 tons of steel, 5000 cu yd of concrete and 16 miles of pipe. Nearly three miles of fencing were put up, a mile and a half of roads built and 100,000 cu yd of earth were moved.

* * *

Preconstructed steel scaffolding is raised by crane beside catalytic cracking unit.



Double vacuum distillation unit at Cit-Con Corporation's new lubricating oil refinery, which began operations in 1949.

Lube Refining Capacity 177,000

Conventional Lube Processing Is Giving Way to Combination Treating for Greater Efficiency, According to Survey of National Petroleum Association.

ONLY ten per cent of the total lubricating oil refining capacity in the U. S. A. can be classed as 'conventional', that is, capacity that does not include any solvent dewaxing, solvent (selective) extraction, or other of the more modern processes other than acid treating, filtration, and similar long-used processes. This was revealed by the latest survey of this field by the National Petroleum Association, in corrected figures announced by E. H. Fallin of that association.

The total reported capacity is 177,057 bbl per day of nominal capacity for output of finished lubes. The total capacity for 'conventional' process plants is 17,749, according to this survey as compared to 19,074 in 1950.

Of this total conventional capacity 3300 bbl per day are not operating at present, leaving 8.15 per cent of the capacity in conventional plants.

The total crude refining capacity of the plants reporting lube processing is 3,381,450 bbl per day, or nearly half the total active refining capacity of the nation as of January 1, 1951.

The figures reported indicate that slightly more than 5 per cent of the total crude capacity in these refineries can go into finished lubricating oils, or less than 3 per cent of our total national refining capacity may become lubricants.

For the processes involved in these plants, other than the so-called 'conventional' units, 36 selective solvent extraction plants are reported with a total charge capacity of 187,760 bbl per day, an amount greater than the total finished lube capacity; of course

U. S. REFINERIES PRODUCING LUBRICATING OILS

Company	Refinery location	Crude capacity B/D	Solvent extraction	Solvent dewaxing	Propane deasphalting	Finished lube capacity	Lube processes
Atlantic Refining Company	Philadelphia, Pennsylvania	117,000	5,600	3,500	3,500	5,000	Nitrobenzene, phenol, MEK-benzol, propane acid and clay.
Bayou State Oil Corporation	Hosston, Louisiana	800	.....	.....	.....	400	High vacuum distillation and acid and clay.
erry Asphalt Company	Waterloo, Arkansas	1,500	.....	.....	.....	350	Spec. vacuum distillation.
alumet Refining Company	Burnham, Illinois	1,200	.....	.....	.....	750	High vacuum distillation.
alumet Refining Company	Princeton, Louisiana	700	.....	.....	.....	425	Crude distillation, acid and clay.
hamplin Refining Company	Enid, Oklahoma	20,000	2,850	.....	.....	1,800	Duo-Sol, phenol.
i teon Corporation	Lake Charles, Louisiana	.....	17,500	8,500	.....	6,000	Duo-Sol, furfural, MEK-benzol.
Cities Service	Ponca City, Oklahoma	20,000	.....	.....	.....	1,050*	Acid and clay.
Continental Oil Company	Ponca City, Oklahoma	52,500	3,750	2,450	.....	1,800	Duo-Sol, furfural, MEK-hexane, barisol, benzol.
Cooperative Refining Association	Coffeyville, Kansas	20,000	1,800	2,000	.....	1,500	Furfural, MEK-benzol.
Henry H. Cross Company	Smackover, Arkansas	6,000	.....	.....	.....	1,000	Vacuum distillation, acid and clay.
Crown Central Petroleum Corporation	Houston, Texas	4,000	.....	.....	.....	1,000	Conventional.
Deep Rock Oil Corporation	Cushing, Oklahoma	18,000	.....	.....	.....	864	Conventional.
Elk Refining Company	Falling Rock, West Virginia	4,000	.....	.....	.....	1,000	Conventional.
Esso Standard Oil Company	Baltimore, Maryland	53,000	.....	.....	.....	100	Conventional.
Esso Standard Oil Company	Bayonne, New Jersey	30,000	2,000	6,000	.....	6,500	Phenol, MEK-benzol, acid and clay.
Esso Standard Oil Company	Baton Rouge, Louisiana	245,000	11,000	8,000	3,500	7,500	Phenol, MEK-benzol, propane dewaxing, and deasphalting, acid, clay.
Freedom-Valvoline Oil Company	Freedom, Pennsylvania	4,000	.....	.....	.....	800	Conventional.
Golden Bear Oil Company	Bakersfield, California	2,500	500	.....	.....	1,100	Furfural
Gulf Oil Corporation	Philadelphia, Pennsylvania	107,000	3,000	1,200b	.....	1,100	Duo-Sol.
Gulf Oil Corporation	Port Arthur, Texas	230,000	11,000	3,400 2,700b	4,000 2,600c	12,000	Furfural, phenol, MEK-benzol, propane, alchlor, sharples dewax.
Humble Oil and Refining Company	Baytown, Texas	260,000	8,500	10,000	7,800	12,200	Propane, phenol, MEK-benzol, acid and clay treating.
Kendall Refining Company	Bradford, Pennsylvania	4,800	900	1,200	1,200	1,200	Phenol, propane, pressing.
Lion Oil Company	El Dorado, Arkansas	22,000	.....	.....	.....	1,000	Vacuum distillation (spec.).
McBride Refining Company	La Blanca, Texas	2,500	.....	.....	.....	100	Conventional.
MacMillan Petroleum Corporation	Norphlet, Arkansas	4,500	.....	.....	.....	1,350	Vacuum distillation (spec.).
Magnolia Petroleum Company	Beaumont, Texas	150,000	9,300	8,500	.....	5,400	MEK-benzol, Duo-Sol, Furfural.
Mid-Continent Petroleum Company	Tulsa, Oklahoma	50,000	5,500	3,000	2,500	5,000	Chlorex, propane.
National Refining Company	Findlay, Ohio	12,000	.....	.....	.....	600	Acid and clay.
Palomar Refining Company	Bakersfield, California	1,300	.....	.....	.....	.....	Vacuum distillation.
Penna. Refining Company	Karns City, Pennsylvania	1,500	.....	.....	.....	300	Conventional.
Pennzoil Company	Oil City, Pennsylvania	8,500	1,000	2,250	.....	2,250	Chlorex, MEK-benzol.
Phillips Petroleum Company	Okmulgee, Oklahoma	8,000	.....	.....	.....	.....	Acid and clay.
Phillips Petroleum Company	Kansas City, Kansas	50,000	3,000	2,000	2,000	1,500	Phenol, propane.
Pioneer Oil and Refining Company	Somerset, Texas	400*	.....	.....	.....	400*	Contact filtration.
Premier Oil Refining Company	Fort Worth, Texas	8,000	.....	.....	.....	700*	Conventional.
Pure Oil Company	Cabin Creek, West Virginia	5,500	.....	.....	.....	450	Conventional.
Pure Oil Company	Nederland, Texas	58,200	.....	.....	.....	2,000	Phenol, MEK, propane.
Quaker State Oil Refining	Emlenton, Pennsylvania	2,000	1,680	2,000	.....	1,700	Furfural, MEK-benzol.
Quaker State Oil Refining	Farmers Valley, Pennsylvania	4,000	1,680	2,700	.....	2,295	Furfural, MEK-benzol.
Quaker State Oil Refining	Oil City, Pennsylvania	2,800	.....	.....	.....	600	Conventional.
Quaker State Oil Refining	St. Marys, West Virginia	2,500	680	.....	.....	600	Furfural.
Richfield Oil Corporation	Watson, California	100,000	.....	.....	.....	275	Conventional vacuum distillation.
Shell Oil Company, Incorporated	Houston, Texas	115,000	5,400	3,700	3,800	2,800	Phenol, propane, MEK-benzol, clay filtration.
Shell Oil Company, Incorporated	Martinez, California	45,000	4,880	.....	.....	3,100	Sulfur dioxide, furfural, acid and clay.
Shell Oil Company, Incorporated	Wood River, Illinois	120,000	3,000	3,600	3,300	3,100	Duo-Sol, propane, acid, and clay.
Sinclair Refining Company	East Chicago, Indiana	85,000	5,100	4,750	4,250	2,300	Propane, phenol, MEK-benzol.
Sinclair Refining Company	Houston, Texas	85,000	3,500	4,000	4,000	3,233	Propane, phenol, MEK-benzol, acid.
Sinclair Refining Company	Wellsville, New York	9,000	.....	1,500	3,500	2,250	Nitrobenzene, MEK-benzol, contact treating.
L. Sonneborn Sons, Incorporated	Franklin, Pennsylvania	1,650	.....	.....	.....	500	Conventional.
L. Sonneborn Sons, Incorporated	Petrolia, Pennsylvania	4,000*	.....	.....	.....	1,000	Conventional.
Socony-Vacuum Oil Company	Olean, New York	7,000	1,300	1,200	.....	1,200	Chlorex, MEK-benzol.
Socony-Vacuum Oil Company	Buffalo, New York	22,000	.....	.....	.....	1,000	.....
Socony-Vacuum Oil Company	Paulsboro, New Jersey	58,000	7,580	5,300	5,950	7,000	MEK-benzol, Duo-Sol, Furfural.
Standard Oil Company of California	Richmond, California	138,000	16,500	5,800	.....	9,000	MEK-benzol, RPM solvent, phenol.
Standard Oil Company (Indiana)	Casper, Wyoming	15,900	600	.....	.....	620	Chlorex.
Standard Oil Company (Indiana)	Whiting, Indiana	192,000	2,500	2,200	1,200	5,060	Phenol, propane.
Standard Oil Company (Indiana)	Wood River, Illinois	43,900	2,300	1,400	.....	1,040	Chlorex, propane.
Standard Oil Company (Ohio)	Cleveland, Ohio	42,500	.....	.....	.....	1,500	Conventional.
Standard Oil Company (Ohio)	Lima, Ohio	46,500	.....	.....	.....	1,800	MEK-Furfural, PDA.
Standard Oil Company (Ohio)	Toledo, Ohio	21,000	.....	.....	.....	900	Conventional.
Sun Oil Company	Marcus Hook, Pennsylvania	140,000	8,000	4,500	.....	11,800	MEK-benzol, mercury vacuum distillation, Duo-Sol, Furfural.
The Texas Company	Lawrenceville, Illinois	47,000	2,000	1,400*	.....	1,150*	Furfural, acetone-benzol.
The Texas Company	Port Arthur, Texas	190,000	18,000	11,000	4,000	16,000	Furfural, sulfur-dioxide, MEK-benzol, propane.
Three Rivers Refinery	Three Rivers, Texas	1,500	.....	.....	.....	750	Vacuum distillation, acid and clay.
Tidewater Associated Oil Company	Avon, California	85,000	1,660	.....	.....	1,660	Sulfur-dioxide.
Tidewater Associated Oil Company	Bayonne, New Jersey	74,000	7,000	3,500	3,400	2,400	Sulfur-dioxide, Furfural, MEK-benzol, propane.
Union Oil Company of California	Oleum, California	72,800	7,200	1,900	.....	1,800	Duo-Sol, phenol, propane, acid, clay.
United Refining Company	Warren, Pennsylvania	5,500	.....	.....	.....	1,400	Semi-conventional.
Utah Oil Refining Company	Salt Lake City, Utah	26,000	.....	.....	.....	85	Conventional.
Wolf's Head Oil Refining Company	Reno, Pennsylvania	2,500	.....	.....	.....	650	Conventional.
		3,381,450	187,760	125,150	60,500	177,057	Total.

b-Sharples dewaxing. c-Alchlor refining. *Not operating at present time.

a varying but considerable percentage of the charge is lost as non-lube extract. Solvent dewaxing units have capacity for handling 125,150 bbl per day of charge.

In Table 2 have been segregated the capacities of the refining plants in which the various licensed lube oil processes are employed. The figures opposite each process name do not indicate the actual capacity of the units operating on these processes, but only the finished lubricating oil capacity of the refinery in which these processes are installed. In some cases all the oil refined in the individual refineries passes through the given process unit; in other cases only a considerable portion of the oil so refined is treated in the individual unit named.

TABLE 2

Name of process	Plant lube capacity finished oil bbl/day
Furfural Process	75,645
Phenol Process	73,893
Duo-Sol Process	39,800
Chlorex Process	10,110
Nitrobenzene Process	7,250
MEK-Benzol Dewax Process (includes acetone-benzol, MEK-Hexane, etc.)	126,078
Propane Dewax Process	79,073
"Conventional" Process Capacity	17,749

This period marks the passing of two old, long-established lube refining plants, the Cities Service (Crew-Levick) plant at Titusville, Pennsylvania, and the equally well-known Waverly Oil Works Company at Pittsburgh. Each was a "conventional" plant, it is understood. * * *

PRACTICAL CALCULATIONS FOR

Shell-and-Tube Heat Exchangers

Theory is developed thoroughly to show methods of application, the most recent equations, and the various factors employed

G. L. FARRAR*

THE use of heat exchangers in process plants is very widespread, and for commercial application the shell-and-tube exchanger is employed for most installations. The term, heat exchanger, may apply to any piece of equipment or portion of a piece of equipment in which heat is transferred, or it may refer to a piece of equipment utilizing heat that would otherwise be wasted. Heat exchangers of the first type are of course necessary to maintain the proper process conditions, and are thus indispensable. Those of the second type are installed to make a given process more economical and may be considered money makers. They are not, however, essential to the process. Both types of exchangers will be discussed in greater detail below.

A heat exchanger should be selected carefully for the job at hand. The design of any heat exchanger requires detailed consideration of the theory of heat flow, pressure drop of the process fluids, type of construction, materials of construction, foundations, supports, etc. It is not the purpose of this article to consider heat exchanger design, except briefly and generally from the economic standpoint. Rather the emphasis will be placed on aspects concerning existing heat exchangers, already installed. The main factors to be considered in this treatment will be heat flow, pressure drop considerations, and maintenance problems.

The operation of a heat exchanger should be checked periodically by determining the rate of heat transfer and observing the pressure drops through the exchanger. Rate of heat transfer may be calculated as shown below. In general decrease in rate of heat transfer and increased pressure drops go hand-in-hand. This means that fouling of the heat transfer surface occurs more or less uniformly. If, as in some cases, rate of fouling is greater at the entrance or exit of the exchanger, the pressure drop will increase comparatively rapidly, while the rate of heat transfer will decrease more slowly. At any rate the exchanger must be taken off stream and cleaned periodically. The cleaning cycle is determined by balancing the increased cost of operation as on-stream time increases, with the cost of cleaning. During the cleaning period the equipment should be inspected for corrosion and erosion effects. As shown later it is possible to predict the expected life of the exchanger from these inspections.

*Assistant Professor of Chemical Engineering, A. & M. College of Texas, College Station.

Theory of Heat Exchanger Calculations

The basis for applied heat transfer equations is Newton's Law of Cooling:

$dt/d\theta = K\ (T - t)$

- t = temperature of a given object or stream
- θ = time
- K = proportionality factor
- T = reference temperature, or temperature of adjacent object or stream
- $dt/d\theta$ = rate of change of given temperature with time

It is possible to derive formally the applied heat transfer equations from this law; however, the mathematics become involved in some instances, and this treatment is beyond the scope of this paper. It will be noted that the derived equations show that rate of heat transfer, or temperature change, is proportional to the temperature difference. For this discussion the applied equations will simply be stated and their applications shown.

Provided that no phase change takes place in a given stream the heat transferred to or from that stream may be calculated by Equation 1.

(1) $q_1 = m_1 c_{p_1} \Delta t_1$

- q_1 = hourly rate of heat transfer, Btu/hr
- m_1 = mass rate of flow, lb/hr
- c_{p_1} = average specific heat of the material over the temperature range involved, Btu/(lb) (F)
- Δt_1 = change in temperature of the stream as it passes through the exchanger, F

This equation applies to the "tube-side" stream which is arbitrarily designated by the subscript "1". If there is no phase change in the shell-side stream, Equation 2 applies.

(2) $q_2 = m_2 c_{p_2} \Delta t_2$

If a phase change occurs, the heat transferred may be determined by, $q = mL$, where L is the latent heat per unit mass. If the temperature varies during the phase change an average latent heat may be used, or the solution obtained by graphical integration of the expression,

$$q = m \int_{t_1}^{t_2} L\, dt$$

If both phase change and sensible heat transfer occur in one or both streams in the exchanger, the exchanger is divided into enough sections so that only one type of heat transfer is considered at a time.

For heat transfer from one stream to another across a resistance (corresponding to the tube wall in a shell-and-tube exchanger) Equation 3 is used to determine the hourly rate of heat transfer.

(3) $q = U A \Delta t_m$

- U = proportionality factor, defined as the "overall heat transfer coefficient," Btu/(hr) (ft²) (F)
- A = area of heat transfer, ft²
- Δt_m = "log mean Δt", F (defined below)

It should be noted that $q_1 = q_2 = q$, under steady state conditions, since all the heat transferred must be re-

EXCLUSIVE

moved from one stream and added to the other.

In considering Equation 3, it should be pointed out that U may vary from one end of the exchanger to the other. If the variation is not great an average U may be used; otherwise U should be expressed as a function of Δt, as shown by Perry[1] in obtaining a solution. The area for heat exchange may be taken as the total inside surface area of the exchanger tubes, or it may be taken as the outside surface area of the tubes. The overall coefficient, U, is based on whichever area is selected. As the same amount of heat must be transferred through both areas, it is apparent that $U_iA_i = U_oA_o$, where *i* and *o* refer to the inside and outside of the tube respectively.

The overall coefficient, U, is calculated from Equation 3, A being known, q being calculated from Equation 1 or 2, and Δt_m being determined from observed temperatures. As a check on operation U may be calculated from the individual heat transfer coefficients for each resistance through which the heat must be transferred. In the case of a shell-and-tube exchanger these resistances are three, the shell-fluid film, the tube wall, and the tube-fluid film. For this situation,

(4) $1/U = 1/h_1 + L/k + 1/h_2$

h_1 = heat transfer coefficient for tube-side fluid film, Btu/(hr) (ft²) (F)

h_2 = heat transfer coefficient for shell-side fluid film, Btu/(hr) (ft²) (F)

L = tube metal thickness, ft

k = thermal conductivity of tube metal, Btu/(hr) (ft²) (F/ft)

The individual heat transfer coefficient may also be observed, or it may be calculated. The general form of the equation for calculating h is,

$$h = f\left(\frac{DG}{\mu}\right) \cdot \phi\left(\frac{c_p\mu}{k}\right) \cdot K$$

f,ϕ = functions that must be defined by the specific conditions at hand

G = mass stream velocity, lb/(hr) (ft²)

D = tube diameter, ft

μ = fluid viscosity, lb/(ft) (hr)

K = proportionality factor

It is apparent that the equation for h of the shell fluid must take some other form, since tube diameter would not be defined. In this case an equivalent diameter, which is defined in terms of the wetted perimeter, is used.[2]

For heating or cooling fluids in turbulent motion ($DG/\mu > 2100$) the following equation may be used with fair accuracy, for calculating h,

$$(5)\quad hD/k = 0.023\left(\frac{DG}{\mu}\right)^{0.8}\left(\frac{c_p\mu}{k}\right)^{0.4}$$

There are, however, a number of equations in the literature that are recommended for specific applications. If one of these equations is available, it should be used. Otherwise, Equation 5 may be used. An example of the application of this equation is shown below.

Example 1: The temperature of water increases from 70 to 90 F as it flows through a 2-in. ID tube at the rate of 75 lb/min. Calculate h for the water, using Equation 5.

Data:

Avg. μ = 0.90 centipoises
Avg. Cp = 1 Btu/(lb) (F)
Avg. k = 0.357 Btu/(hr) (ft²) (F/ft)

Solution:

$$G = 60 \times 75 \times \frac{4 \times 144}{\pi \times 4} = \frac{648{,}000}{\pi} = 206{,}000 \text{ lb/(hr) (ft²)}$$

$$\mu = 0.90 \times 2.42 = 2.18 \text{ lb/(ft) (hr)}$$

$$h = \frac{0.357 \times 12}{2} \times 0.023 \left(\frac{2 \times 206{,}000}{12 \times 2.18}\right)^{0.8}\left(\frac{1 \times 2.18}{0.357}\right)^{0.4}$$

$$h = 0.0493\ (15{,}800)^{0.8}\ (6.10)^{0.4}$$

$$h = 0.0493 \times 2300 \times 2.06 = 234 \text{ Btu/(hr) (ft²) (F)}$$

The log mean Δt appearing in Equation 3 is defined as the difference of the terminal Δt's, divided by the natural logarithm of the ratio of the terminal Δt's.

$$(6)\quad \Delta t_m = \frac{\Delta t_1 - \Delta t_2}{\ln \dfrac{\Delta t_1}{\Delta t_2}}$$

Δt_1 and Δt_2 are further defined graphically in Fig. 1. As shown in this figure, Δt_1 is usually chosen as the larger temperature difference. The results would be identical, however, regardless of this choice.

As shown in Fig. 1, there are three general types of operation in heat exchangers that result in three typical temperature patterns. The first type is known as counter-current operation. In this case the hot fluid comes in at one end of the exchanger and the cold fluid comes in at the other. Thus, the hotter fluids are exchanged at one end and the colder fluids exchanged at the other end. It may be seen that it is possible for the exit temperature of the cold fluid to be greater than the exit temperature of the hot fluid, although this is not recommended for good operation as excessive surface is required. The second type of operation is known as con-current operation. The hot and cold fluids enter at the same end of the exchanger and the exchanged fluids leave at the same end of the exchanger. As may be seen from the figure, it is impossible for the exit temperature of the cold fluid to be greater than the exit temperature of the hot fluid, and it is economically unfeasible to provide the large surface necessary to allow the temperatures to approach each other closely.

The third type of operation occurs

[1] Perry, J. H., *Chemical Engineers' Handbook*, 3rd Ed., McGraw-Hill, Eqn. 23, p. 465.

[2] Perry, J. H., *Chemical Engineers' Handbook*, 3rd Ed., McGraw-Hill, pp. 472-473

FIG. 1. Heat exchanger flow-temperature relationships.

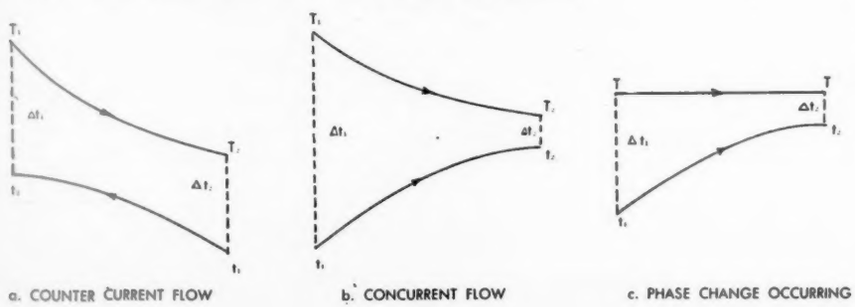
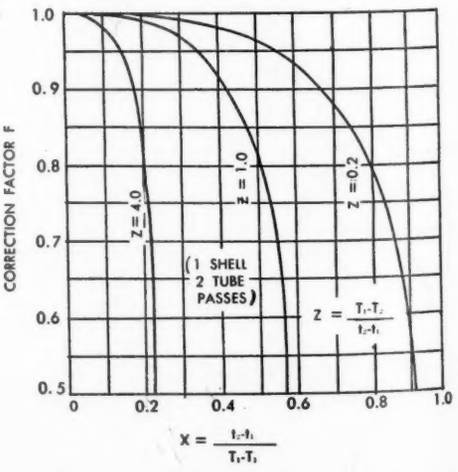
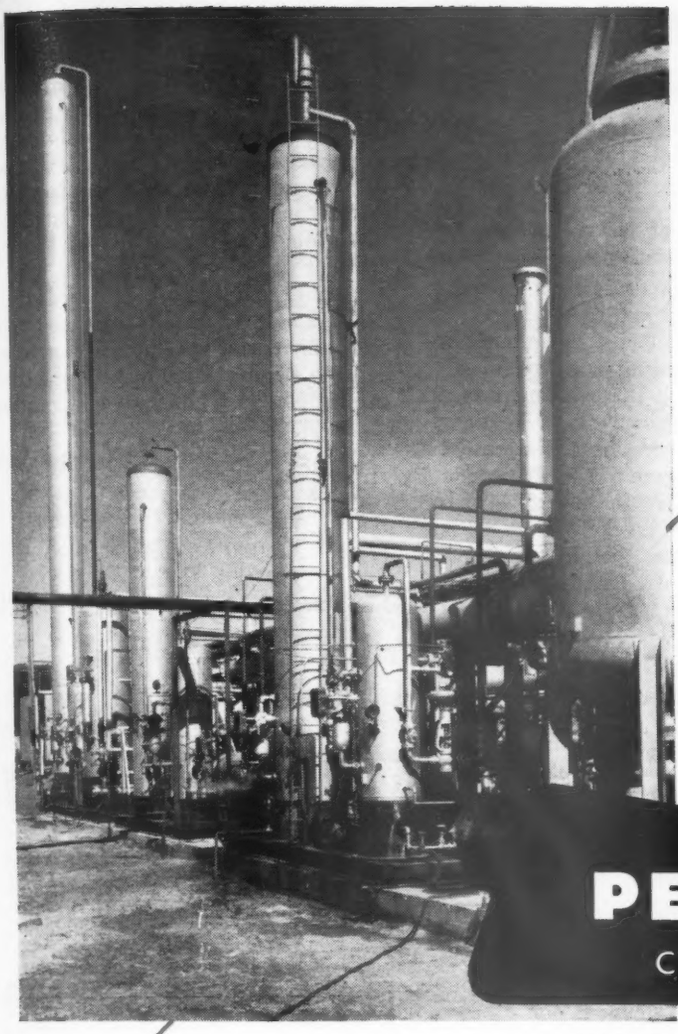


FIG. 2. Correction factor for Δt_m. (Counter-current flow.)





PERCO
CYCLOVERSION

AT GLADEWATER TEXAS

CYCLOVERSION —
FOR LOW OPERATING COST

SKID-MOUNTED —
FOR LOW INSTALLATION COST

PREFABRICATED —
FOR LOW CONSTRUCTION COST

Gladewater Refining Company recently installed this Perco Cycloversion unit to reform straight run gasoline or desulfurize cracked stocks at the rate of 600 barrels per stream day. Engineering and construction were by Grebe & Doremus Process Co., Houston, who shop fabricated the unit and mounted it on three skids for installation on site. Write us about Cycloversion for you!

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Phillips 66

when a phase change takes place in one of the fluids. This usually takes place at constant temperature, or at substantially constant temperature. In this case there is only one type of operation possible, as shown by Fig. 3. The terms, con-current and counter-current lose their significance in this case.

The log mean Δt is used in Equation 3, based on the assumption that the temperature patterns are continuous as shown in Fig. 1. In a shell-and-tube exchanger, however, this is not the case, except for type 3 operation. As the shell fluid passes back and forth across the tubes, it alternately contacts tubes containing fluid at somewhat different temperatures, as shown in Fig. 3. This means that the correct Δt to be used in Equation 3 is somewhat less than Δt_m. Consequently, correlations have been worked out to provide the proper correction for this deviation. A typical correlation of this nature is shown schematically in Fig. 2. These particular curves apply to an exchanger with one shell pass and two tube passes. Detailed curves for this case and correction curves for any number of shell and tube passes are given by Perry.[3] It will be seen from Fig. 2 that the correction factor, "F," will more nearly approach unity as the number of tube and shell passes are increased, as the temperature patterns are more nearly continuous.

The calculation of pressure drops in heat exchangers is mainly a design problem and will not be discussed here. Reference is made Tubular Exchanger Standards[4] for those interested. For operation purposes it is sufficient to measure the pressure drops across the shell and tubes in the new or recently cleaned exchanger and compare them with the values obtained after successive cumulative periods of operation. Additional cost of pumping can then be obtained, knowing the mass flow rates of the two streams.

[3]Perry, J. H., *Chemical Engineers' Handbook*, 3rd Ed., McGraw-Hill, pp. 466-467.

[4]"Standards of Tubular Exchanger Manufacturers Association," 2nd. Ed.

Application of Heat Transfer Equations

In the final analysis heat exchangers are designed and operated either to show minimum cost or maximum profit. The minimum cost consideration applies when the exchanger is a condenser or reboiler, etc., depending on cooling water to absorb unwanted heat energy or steam to supply needed energy. The maximum profit consideration applies when the exchanger is used to utilize heat that would otherwise be wasted. An example pertaining to this latter type is given below as Example 2.

Example 2: An oil heater is to be purchased to heat 40,000 gal/hr of oil at 65 F by means of exhaust steam at 2 psig. For a shell-and-tube heater previous experience on units of this type has shown that a U of 75 can be expected if the oil is heated to within 20 to 30 deg of the steam temperature. Heater cost is \$3 per ft² installed, in the required area range, with 40 per cent annual charges. The heater saves fuel in a still and the heat added to the oil may be valued at \$0.40 per million Btu. The exhaust steam is considered to have no value. The heater may be expected to be in service one-third of the total time in the year. Estimate the economical temperature to heat the oil, and the heating surface required. Heat losses and additional cost of pumping (due to pressure drop through the exchanger) may be neglected.

Data:

Avg. c_p of oil = 0.5 Btu/(lb) (F) for this temperature range.

Avg. sp. gr. of oil = 0.90 (Referred to water at 60 F.)

Solution: Values for exit oil temperature will be assumed, and the heat added to the oil will be calculated by Equation 1. The fuel savings will then be computed. The area required for the exchanger will be calculated by Equation 3, and the cost of the exchanger computed.

Steam temperature (2 psig) = 218.5 F (It is usually assumed that only latent heat is removed from condensing steam; consequently, the shell side will be at a constant temperature of 218.5.)

Assume exit oil temperature of 210 F,

By Equation 3, $q_1 = m_1 c_{p_1} \Delta t_1$

$m_1 = 40{,}000 \times 8.33 \times 0.90 = 300{,}000$ lb/hr

$\Delta t_1 = 210 - 65 = 145$ F

$q_1 = 300{,}000 \times 0.5 \times 145 = 21.75 \times 10^6$ Btu/hr

Fuel Saving = (21.75×10^6) $(24 \times 365 \times 1/3)$ (\$0.40/10^6).

Fuel Saving = \$25,400 per year.

To calculate required area, $q = U A \Delta t_m$ (Equation 3).

$$A = \frac{q}{U \Delta t_m}$$

$q = q_1 = 21.75\ 10^6$ Btu/hr

$$\Delta t_m = \left[\frac{(218.5 - 65) - (218.5 - 210)}{\ln \frac{(218.5 - 65)}{(218.5 - 210)}}\right]$$

$\Delta t_m = 145/2.89 = 50.3$ F

$$A = \frac{21.75 \times 10^6}{50.3 \times 75} = 5{,}780 \text{ ft}^2$$

Yearly cost of exchanger = $\$3.00 \times 0.40 \times 5{,}780 = \$6{,}940$.

FIG. 3. Flow patterns in multipass exchangers.

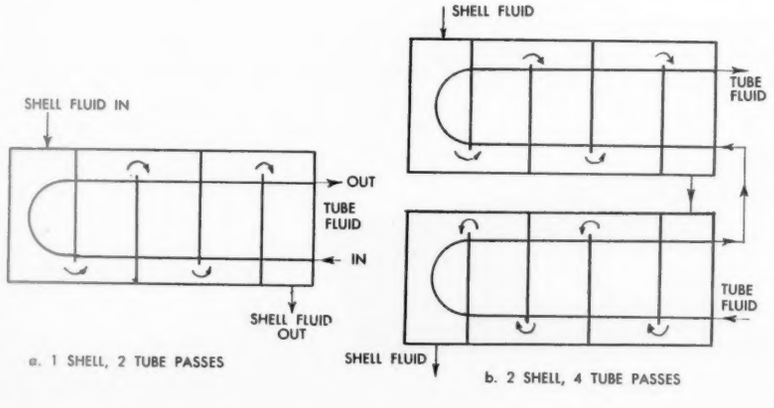
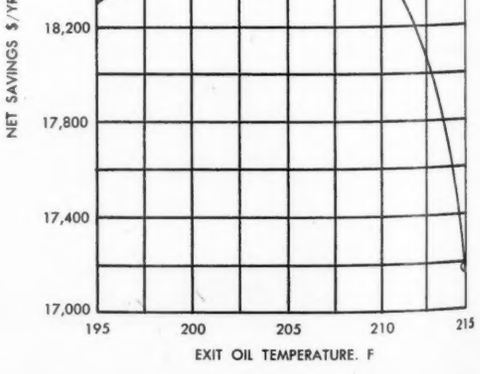


FIG. 4. Heat exchanger savings.



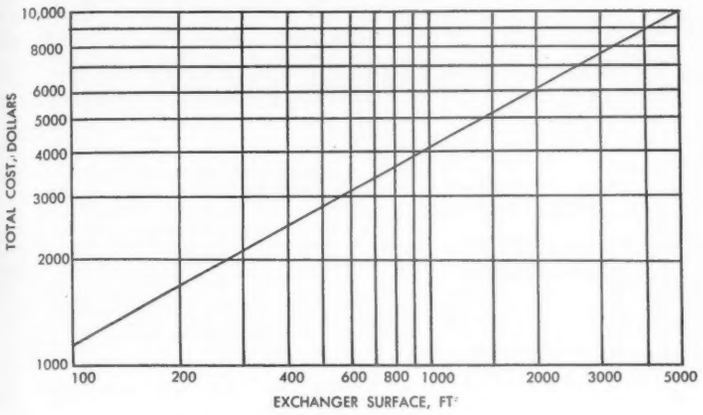


FIG. 5. Approximate exchanger costs.

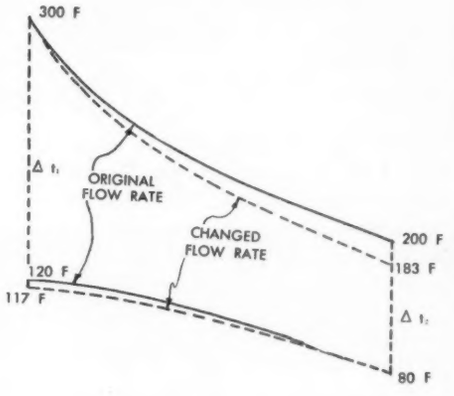


FIG. 6. Oil exchanger flow-temperature patterns.

Saving = fuel saving — yearly cost of exchanger.

Saving = \$25,400 — \$6,940 = \$18,460 per year.

The following table shows values of saving and required area for assumed exit oil temperatures of 210, 215, 205, and 200 F.

Temperature of exit oil	Δt_2	q	Fuel saving	Δt_m	A	Exchanger cost	Net saving
210	145	21.75×10^6	\$25,400	50.3	5,780	\$6,940	\$18,460
215	150	22.50×10^6	26,250	39.7	7,570	9,080	17,170
205	140	21.00×10^6	24,500	57.7	4,850	5,825	18,675
200	135	20.25×10^6	23,650	63.8	4,230	5,080	18,570

The net saving is plotted as a function of temperature in Fig. 4. This plot shows that the maximum savings occur at a temperature of 204.7 F (or 205 F), corresponding to a heat exchange surface of about 4800 sq ft.

It is interesting to note that the point of maximum savings may be calculated analytically by obtaining an equation for savings, in terms of the exit oil temperature, differentiating this equation, and setting dS/dt =0. This is shown below.

Savings = (value of heat saved) — (cost of equipment).

Value of heat saved $= 300{,}000 \times 0.5 \times (t - 65) \times \frac{365}{3} \times \frac{0.40}{10^6}$

Value of heat saved $= 175.8\ (t - 65)$.

Cost of equipment $= 0.40 \times 3.00 \times A$.

$$A = \frac{q}{U\ \Delta t_m};\quad q = q_1 = m_1 c p_1\ \Delta t_1$$

$$A = \frac{300{,}000 \times 0.5 \times (t - 65)}{75\ \dfrac{(218 - 65) - (218 - t)}{\ln \dfrac{(218 - 65)}{(218 - t)}}}$$

$$A = \frac{(150{,}000)\ (t - 65)}{75\ \dfrac{(t - 65)}{\ln \dfrac{(218 - 65)}{(218 - t)}}}$$

$$= 2{,}000 \ln \frac{(218 - 65)}{(218 - t)}$$

$$\text{Savings} = 175.8\ (t - 65) - 0.40 \times 3.00 + 2{,}000 \ln \frac{(218 - 65)}{(218 - t)}$$

$$dS/dt = 175.8 - \frac{2405}{(218 - t)} = 0$$

$$t - 218 = -\frac{2405}{175.8} = -13.7$$

$$t = 218 - 13.7 = \mathbf{204.3\ F}$$

Note that this checks very closely with the value of 204.7, found graphically. Surface area and cost of equipment can now be found by substituting back in the expressions for these values.

It is frequently necessary to know the cost of a new heat exchanger of a given area, in order to determine the feasibility of new installations. For the final detailed estimate a quotation should be obtained from a manufacturing company. For a preliminary estimate, however, approximate costs will suffice. The approximate cost of a shell-and-tube exchanger, with steel tubes 20 ft long, steel shell, and designed for 150 psig pressure throughout, is shown in Fig. 5. As seen from this figure, the plot is a straight line on log-log paper, indicating that cost per unit area drops steadily as area is increased. Plots of this nature may be constructed for the purpose of cost estimation. If tube length is shortened, pressure increased, or special alloys used, the cost will increase.

As was indicated above, it is often necessary to correct Δt_m in a shell-and-tube exchanger for discontinuities in the temperature pattern. At least it is necessary to check the necessity of making the correction. Examples of this procedure are shown below.

Example 3: The terminal temperature differences on a shell-and-tube heater, counter-currently exchanging two oil streams are as follows:

Hot oil, $T_1 = 450$ F; $T_2 = 225$ F.

Cold oil, $t_1 = 75$ F; $t_2 = 200$ F.

Calculate Δt_m and corrected Δt_m (equal to F $\times$ Δt_m) to be used in Equation 3, if (1) the exchanger has 1 shell and 2 tube passes; (2) the exchanger has 2 shell passes and 4 tube passes; and (3) the exchanger has 3 shell passes and 6 tube passes.

Solution:

$$\Delta t_m = \left[\frac{(T_1 - t_2) - (T_2 - t_1)}{\ln \dfrac{(T_1 - t_2)}{(T_2 - t_1)}} \right]$$

(Equation 6)

For (1)

$$\Delta t_m = \left[\frac{(450 - 200) - (225 - 75)}{\ln \dfrac{(450 - 200)}{(225 - 75)}} \right]$$

$$\Delta t_m = 100/0.511 = 196\ \text{F}$$

$$Z = \frac{T_1 - T_2}{t_2 - t_1} = \frac{450 - 225}{200 - 75} = 1.80$$

$$X = \frac{t_2 - t_1}{T_1 - t_1} = \frac{200 - 75}{450 - 75} = 0.334$$

From Perry,[5] F = 0.87 for 1 shell and 2 tube passes

Δt_m corr. $= 0.87 \times 196 = 171$ F

For (2),

Considering 2 shell and 4 tube passes, at the same values for X and Z (since they do not change with number of passes),

F = 0.96

Δt_m corr. $= 0.96 \times 196 = 188$ F

For (3), 3 shell and 6 tube passes,

F = 0.98

Δt_m corr. $= 0.98 \times 196 = 192$ F

It may be desirable to change the mass rate of flow of one or both of the process streams to the exchanger, or some upset in the overall process may cause variation in flow rates. To predict the consequence of either of these conditions requires somewhat careful analysis of the exchanger operation. This is demonstrated in Example 4.

Example 4: 1000 bbl/hr (corrected to 60 F) of oil are being cooled from 300 F to 200 F in a shell-and-tube exchanger with two shell passes and four tube passes. Hot oil is on the tube side. Cold oil comes in at 80 F and leaves at 120 F in counter-current flow. (A) Calculate the hourly rate of heat transfer in the exchanger and flow of cold oil to the exchanger. (B) If the hot oil charge rate is reduced by 20 per cent, and the flow of cold oil remains unchanged, calculate the exit temperatures of the oil streams and the hourly rate of heat transfer after steady state conditions have again been attained.

Data:

c_p for both streams = 0.6 Btu(lb)(F).

Avg. sp. gr. for cold oil = 0.83 (referred to water at 60 F).

Avg. sp. gr. for hot oil = 0.80.

Avg. U is substantially unchanged by the change in conditions.

Solution: The "F" factor will be checked first.

$$Z = \frac{T_1 - T_2}{t_2 - t_1} = \frac{300 - 200}{120 - 80} = 2.50$$

$$X = \frac{t_2 - t_1}{T_1 - t_1} = \frac{120 - 80}{300 - 80} = 0.182$$

F = 1

It will be assumed that this factor will also be unity under the final conditions. This assumption will be checked after the new temperatures are calculated.

(A) Under the original conditions,

$$\Delta t_m = \frac{(300 - 120) - (200 - 80)}{\ln \dfrac{(300 - 120)}{(200 - 80)}}$$

$$= \frac{60}{\ln 1.5}$$

$\Delta t_m = 148$ F

Hot oil flow $= 1{,}000 \times 42 \times 0.8 \times 8.33 = 280{,}000$ lb/hr.

$q_1 = m_1 c_{p1} \Delta t_1$ (Equation 1)

$q_1 = 280{,}000 \times 0.6 \times (300 - 200) = 16{,}800{,}000$ Btu/hr

$q = 16{,}800{,}000 = U A \Delta t_m$ (Equation 3)

$U A = 16{,}800{,}000/148 = 113{,}500$

As U remains unchanged, U A will also remain unchanged.

For cold oil flow, $q_2 = m_2 c_{p2} \Delta t_2$ (Equation 2).

$q_2 = q_1 = 16{,}800{,}000 = m_2 \times 0.6 \times (120 - 80)$.

$m_2 = 700{,}000$ lb/hr

Flow rate $= \dfrac{700{,}000}{42 \times 0.83 \times 8.33} = 2{,}410$ bbl/hr

(B) After the change in oil flow,

$q_1 = (280{,}000 \times 0.80) \times 0.6 \times (300 - t_2)$ (Equation 1).

$q_1 = 134{,}400\ (300 - t_2)$.

$q_2 = 700{,}000 \times 0.6 \times (T_2 - 80)$ (Equation 2).

$q_2 = 420{,}000\ (T_2 - 80)$

$$q = 113{,}500 \left[\frac{(300 - T_2) - (t_2 - 80)}{\ln \dfrac{(300 - T_2)}{(t_2 - 80)}} \right]$$

(Equation 3)

Thus it is seen that there are three equations and three unknowns; however, since one of the relationships is in logarithmic form, a trial-and-error solution is necessary. The procedure will be to assume t_2. Then q_1 can be calculated from Equation 1. As $q_2 = q_1$, T_2 can be calculated from Equation 2. Using these calculated values for t_2 and T_2, q will be determined by Equation 3. If calculated q is equal to q_1, the assumption is correct. Otherwise, other trials must be made.

Assumption 1: Assume $t_2 = 150$ F

$q_1 = 134{,}400\ (300 - 150) = 20{,}200{,}000$

$$T_2 - 80 = \frac{20{,}200{,}000}{480{,}000} = 43.4 \text{ F}$$

$T_2 = 123.4$ F

$$q = 113{,}500 \left[\frac{(300 - 123.4) - (150 - 80)}{\ln \dfrac{(300 - 123.4)}{(150 - 80)}} \right]$$

$q = 113{,}500 \times 115.3 = 13{,}100{,}000$

Thus $q \neq q_1$, and the original assumption was wrong. A tabulation of the various values for other assumptions is shown below. The correct value for t_2 is seen to be 183 F (within 1 deg), and q, to be 15,800,000 Btu/hr. T_2 is 117 F. A comparison of old and new conditions is shown in Fig. 6.

Assumed t_2	$q_1 = q_2$	T_2	Δt_m	q
150	20,200,000	123.4	115.3	13,100,000
175	16,800,000	120.0	133.0	15,100,000
180	16,100,000	118.4	136.9	15,500,000
183	15,720,000	117.4	139.1	15,790,000

It is interesting to note that although the cold charge rate is reduced by 20 per cent, the amount of heat transferred is

$$\frac{15{,}800{,}000}{16{,}800{,}000} \times 100 =$$

94 per cent of the original amount.

A check on the "F" factor under the final conditions will now be made.

$$Z = \frac{300 - 183}{117 - 80} = 3.16$$

$$X = \frac{117 - 80}{300 - 80} = 0.168$$

F = 1, and the original assumption is checked

Maintenance

The cleaning of heat exchangers may either be done "in place," or the exchanger may be dismantled and the cleaning done mechanically. Recently, more and more companies are using "in place" cleaning, at least for exchangers operating under certain conditions. The advantages of this type of cleaning are almost obvious, in that there is less down time, labor cost is lowered, and there is a good possibility that the cleaning may be more thorough and uniform than if it were done mechanically. Too, metal loss is kept at a minimum, and the amount that is lost is removed more or less uniformly from the whole heat transfer surface. There is a tendency to begin "in place" cleaning by steaming out the exchanger for several hours. Unless it is definitely known that the scale is water soluble, this practice is not recommended. Numerous investigators have reported that steaming may remove the more volatile compounds from the scale, thereby rendering the remaining material either very gummy and sticky or very hard and impervious. Thus the task of removing the scale is made more difficult.

"In place" cleaning may be done in several ways, depending on the specific situation. Steaming, followed by a hot water wash has proved very successful for water-soluble scale. In other cases three general procedures

[5] Perry, J. H., *Chemical Engineers' Handbook*, 3rd Ed., McGraw-Hill, Fig. 7b, p. 465.

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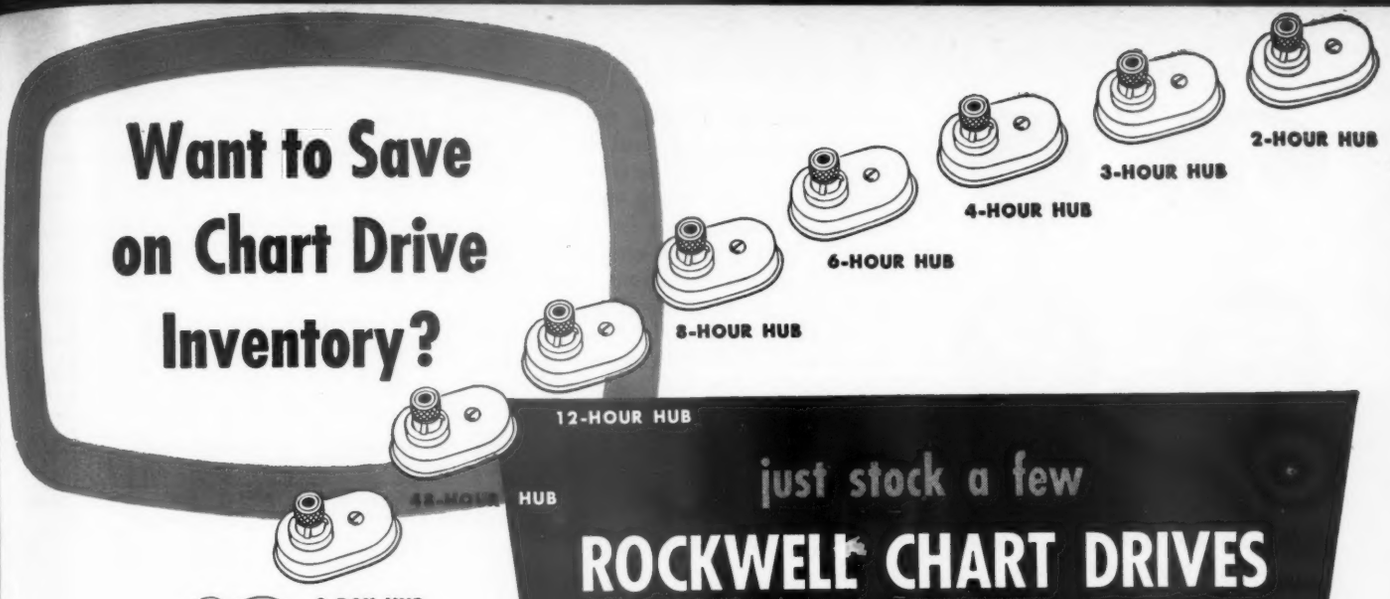

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are used. The cleaning may be done by using a cleaning fluid that will react chemically with the scale, with the reaction product being soluble in the cleaning fluid. Acids or alkalis are usually used when employing this method. A second general method is to remove the scale by dissolving it in a suitable solvent. The choice of solvent will of course depend on the characteristics of the scale. The third method consists of removing the scale in suspension or emulsion in a suitable dispersing or emulsifying agent. Special emulsifying oils are used for this purpose. Should any one of these three methods be applicable, it should prove successful.

Until recently by far the majority of cleaning of heat exchangers was done by mechanical means, and there is still wide application of these methods. In some instances, such as severely plugged tubes or a high percentage of plugged tubes, mechanical cleaning must be used. The four general methods used in mechanical cleaning are brushing, lancing, drilling and rodding, and sand blasting.

The brushing technique is employed when the scale is not gummy and when it is easily removed from the metal surface. Circular wire brushes powered by rotary drills are used to clean out the tubes and hand brushes are used to clean off the tube bundle and to clean out the shell. Lancing is used to unplug tubes in which the scale is not bound too tightly to the metal. In this operation, a high velocity jet of steam, air, or water is directed into the tube, thus forcing the scale out of the tube.

The third type of mechanical cleaning is by drilling and/or rodding. In rodding, a solid rod, just a little smaller than the internal diameter of the tube, is forced through the tube, thus pushing the scale ahead of it. If the scale is tightly bound to the tubes, drilling using a rotary bit is employed. All mechanical cleaning devices except lancing remove appreciable amounts of metal, and drilling removes more metal than any of the other methods.

In addition to removing excessive amounts of metal, mechanical methods of cleaning usually result in scored tubes, with small metal "points" left on the surface. The points serve to increase the fouling and corrosion rates when the exchanger is again put into service. Consequently, great care should be used when cleaning exchangers by mechanical means.

Sand blasting is the most satisfactory method of mechanical cleaning, when judged from the standpoint of subsequent performance of the exchanger. All tubes must be open and free from gummy deposits for sand blasting to be most successful. When these conditions are met, sand blasting removes the scale uniformly with little or no appreciable metal loss. A smooth surface is left, and heat transfer rates, and rates of fouling and corrosion compare very favorably with the performance of new metal tubes.

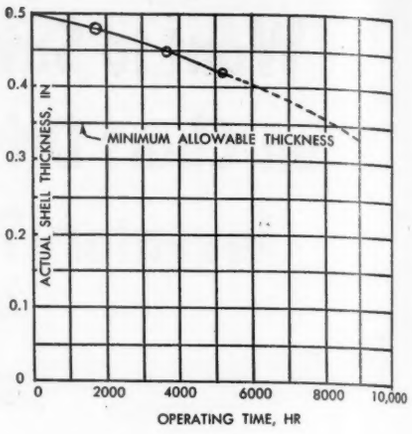


FIG. 7. Predicted life of heat exchangers.

The factors, corrosion and erosion are very important considerations in the maintenance of heat exchangers. They determine the useful life of the exchanger, the extent and frequency of repairs, and the materials of construction chosen for fabricating the exchanger. It is usually not necessary that a detailed study of corrosion be made each time the exchanger is cleaned; however, this will depend on the specific application. Three general methods are in use for determining the extent of corrosion and erosion in process vessels. The first of these is visual, and in this method the metal surfaces are carefully inspected to determine the presence of pits and irregularities. If these are found, or if there are signs of appreciable metal wear, additional tests are made by physical means, or by magnaflux inspection.

Housman[6] has suggested a method for predicting the remaining life of exchangers, based on the results of corrosion tests and inspections. This method is substantially the same as that shown graphically in Fig. 7. The metal thickness is shown as the ordinate, and the minimum safe thickness is determined from the required pressure specifications and the size of the equipment. Thickness of metal is plotted as a function of hours in "on-stream" service, and the curve is extrapolated to the minimum thickness line. It is then possible to read the expected life of the exchanger on the abscissa at that point.

[6]Housman, J. G., *The Petroleum Refiner*, Vol. 26, No. 7, p. 577, July, 1947. ★ ★ ★

FIG. 2

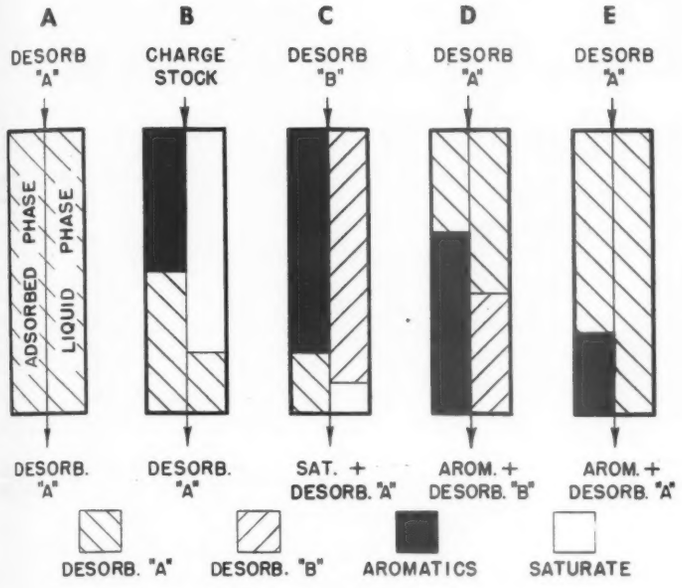


FIG. 1

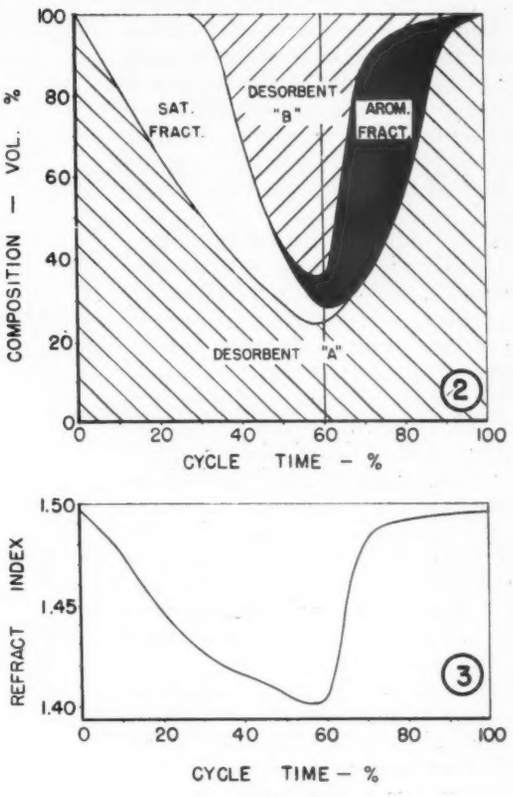


FIG. 3

New Adsorption Process Recovers Aromatics

Arosorb process uses new silica gel adsorbent to concentrate benzene, toluene, xylenes, and other aromatics from distillates

SUN OIL COMPANY announces a new process to separate aromatics which it designates as the Arosorb process—a contraction of aromatic adsorption. The process will be available to industry generally through a licensing program under Sun Oil patent rights.

Benzene is already in critically short supply and, in the event of all-out war, other aromatics, especially toluene and xylenes, become "musts" for supplying both military and essential civilian requirements.

The Arosorb process is a commercial development by Sun of the analytical tool of silica gel adsorption used so successfully by Dr. F. D. Rossini, of the American Petroleum Institute's Project No. 6 in his outstanding work on the analysis of petroleum. This technique was further developed extensively by Sun as an analytical procedure and, recognizing the possibilities of commercialization, Sun Oil Company's research teams of chemists, physicists and engineers spent more than 8 years in developing the present process.

The Arosorb process will be incorporated in a new plant costing over $8,000,000 soon to be erected at Sun's Marcus Hook refinery in response to the government's appeal for the production of aromatics. The new plant will couple an Arosorber with a 10,000-bbl per day Houdriformer. The job of the Arosorber will be to concentrate and purify the aromatics to specification products.

The new plant will produce 13,000,000 gal per year of benzene, 30,000,000 gal per year of toluene, and 15,000,000 gal per year of xylenes.

While Sun's immediate application of the Arosorber is to overcome shortages brought on largely by the current world situation, it has the advantage of great flexibility. This permits adapting the process to the recovery of other products such as DDT solvents and other solvents, improved furnace and diesel oils. In fact, the Arosorber is not limited to the petroleum industry but can be used by the chemical and other industries for the separation of chemicals otherwise difficult to recover or purify. The versatility of the Arosorb Process is a feature certain to have a great appeal to many refiners and manufacturers.

The new process will be the first large scale commercial application of selective adsorption utilizing silica gel. Silica gel is a synthetic amorphous form of silica, with unusual effectiveness in adsorbing preferentially one type of compound from a mixture of several types. Each particle of silica gel has countless micropores averag-

ing about one ten-millionth of an inch in diameter. These pores offer surface area for adsorption of about 90 acres per pound. Because of size, weight or arrangement, each type of molecule is held by the silica gel with a differing degree of tenacity. From this property is derived the term "selective adsorption."

In the process a stream containing the desired aromatics is passed through a bed of silica gel which retains the aromatic portion and allows the saturate portion to pass out the bottom of the bed. When the capacity of the gel for adsorption of aromatics has been reached, the feed is shut off and the gel bed desorbed. One of two desorbents washes out of the bed the residual saturate material from the charge stock and then the other desorbent gradually desorbs or displaces the aromatics adsorbed on the gel. When desorption is substantially complete, the charge stock is readmitted and the cycle repeated.

Fig. 1 shows the steps involved in the cycle in somewhat greater detail. At the end of one cycle, which is the start of the next, as shown in Fig. 1-A, the entire case is filled with desorbent 'A.' As indicated, this desorbent is present both in the adsorbed phase (schematically represented by the left-hand side of the diagram) and in the liquid phase (right-hand side of the figure). Fig. 1-B represents the situation at the end of the charge stock period. The adsorbed phase (left) now contains the aromatics from the feed and approximately an equal amount of desorbent 'A.' The liquid phase (right) is mainly the saturates originally present in the feed. The effluent from the case is substantially desorbent 'A.'

Fig. 1-C indicates the conditions prevailing after the addition of desorbent 'B,' which serves principally to displace saturate material from the liquid phase. The fourth diagram reflects the effect of starting the addition of desorbent 'A.' Here the aromatics from the charge stock are being displaced from the adsorbed phase along with desorbent 'B' from the liquid phase. The fifth figure shows what happens near the end of the desorption step. Almost all the aromatics from the charge have been displaced and the case is again nearly full of desorbent 'A.' The next step will be a complete return to the conditions prevailing in Fig. 1-A and the start of a new cycle.

In actual operation the flow through the case is continuous and there is a gradual increase and decrease of the various components in the effluent. This is pictured by the phase diagram in Fig. 2 which gives the composition of the effluent at all points throughout the cycle. In this example, the product would be diverted from the saturate effluent receiver to the aromatic one at approximately 60 per cent of the cycle. Fig. 3 gives a plot of the refractive index of the effluent against per cent of cycle to show how readily the course of the cycle may be followed and controlled by suitable instrumentation as discussed later.

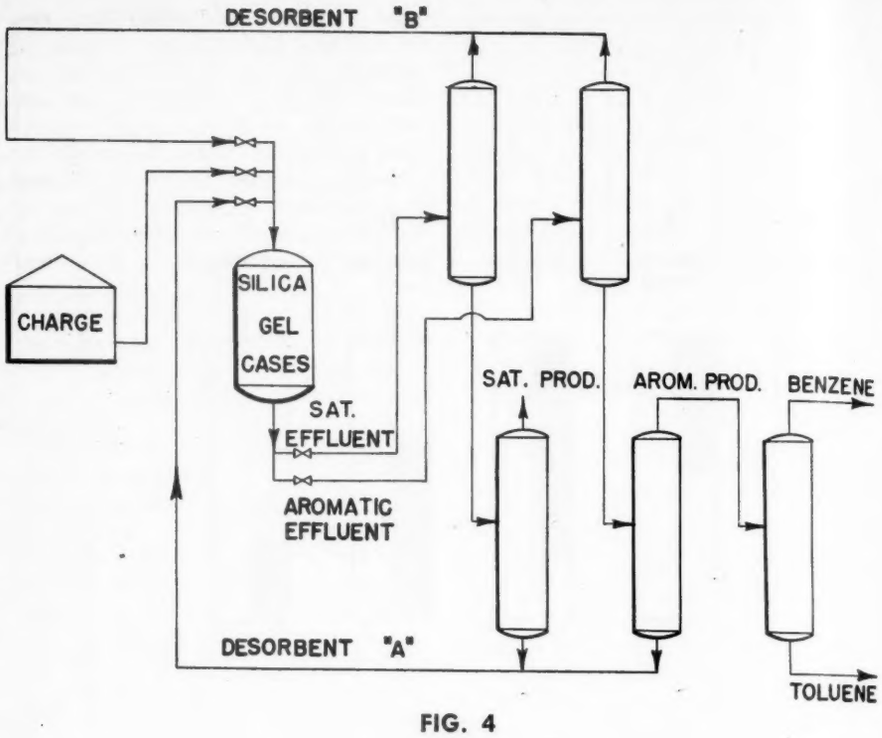


FIG. 4

As the aromatic and saturate streams both contain desorbents 'A' and 'B,' they are each sent to two distillation towers to recover these desorbents.

Fig. 4 is a flow sheet of the process approximately as it will be applied in Sun's Marcus Hook refinery. For simplicity, only one of the several gel cases is shown. The feed stock and the two desorbents enter the top of the case in suitable sequence through the inlet manifold. The saturate effluent flows to a train of two distillation columns in the first of which desorbent 'B' is removed as an overhead product and recycled. The saturate portion of the charge is recovered overhead in the second fractionator, with desorbent 'A' as a bottoms that is also recycled.

The aromatic effluent is similarly handled except that, as a mixture of benzene and toluene will be processed, a third tower is added to the train to act as a benzene-toluene splitter. Naturally the precise sequence of recovery can be altered to suit convenience or economic situation.

Desorbents 'A' and 'B' are hydrocarbon streams having boiling points different from those of the charge stock. In Sun's plant desorbent 'A' will consist of mixed xylenes and desorbent 'B' will be butane. About 2 bbl of desorbent 'A' and 0.5 bbl of desorbent 'B' will be required per barrel of charge or, by analogy with solvent refining, a solvent dosage of 250 per cent. In the Arosorber, however, four-fifths of the "solvent" is taken as a bottoms product and does not need to be distilled.

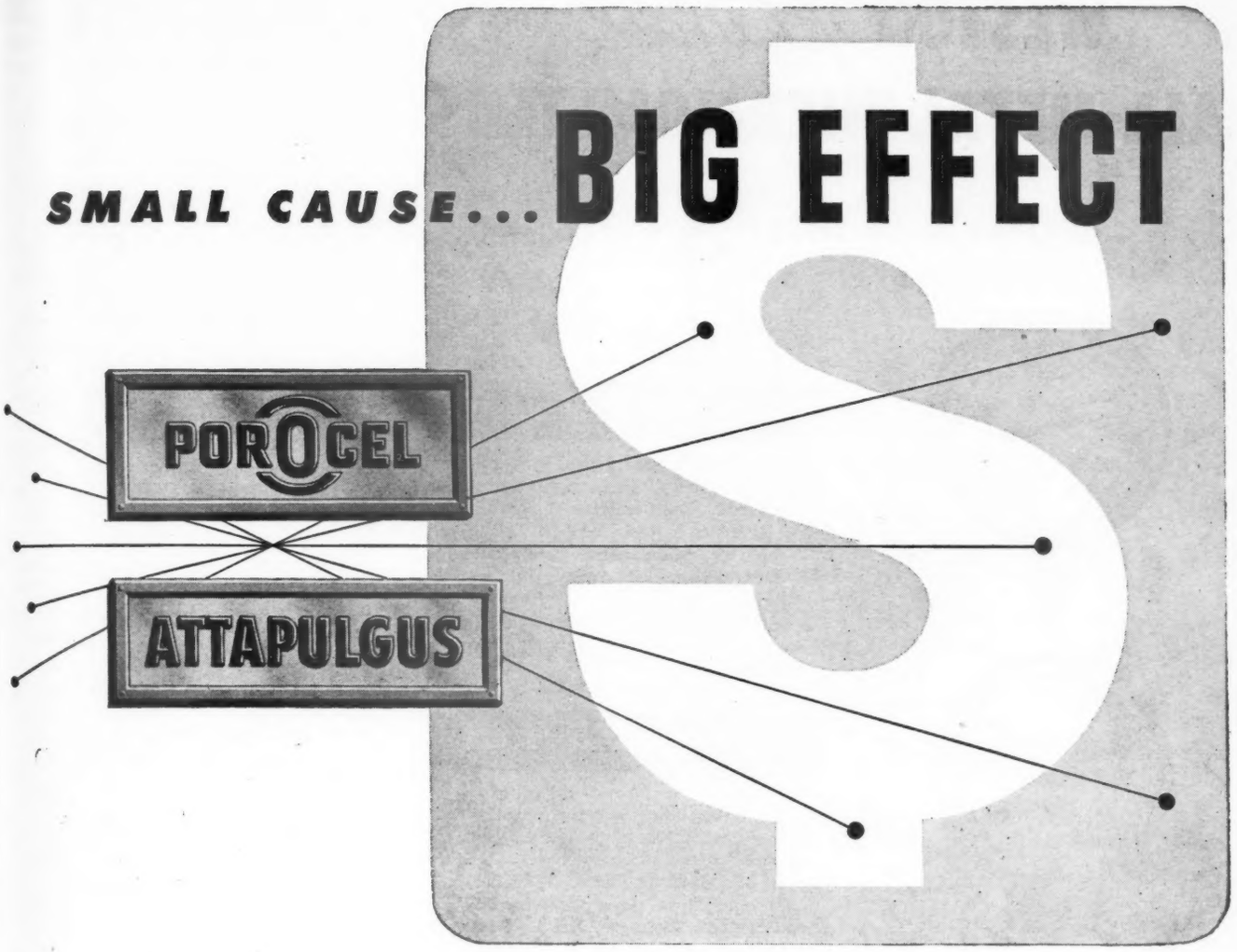
The figures above are for a feed containing 35 per cent aromatics. The ratio of desorbents to charge would decrease with a lower-aromatic content feed and increase with a higher aromatic feed.

The Sun unit will have six silica gel cases 10 ft in diameter and about 20 ft high and containing a total of approximately 500,000 pounds (250 tons) of gel. The gel used is a special form of silica gel supplied by the Davison Chemical Corporation of Baltimore, Maryland, and developed by them in cooperation with Sun's research staff over the past several years.

Each silica gel case will go through 15 cycles per day or one about every 100 minutes. The cycles are staggered, like a 6-cylinder engine, to provide substantially continuous operation.

A gel life of one year is predicted from pilot plant life studies. The gel will be protected from moisture and other poisons by regenerative, pretreatment driers on each of the three streams feeding the cases. At the end of its life the gel will be discarded and replaced with fresh material. Replacement of gel can be accomplished in one case at a time thus not destroying

SMALL CAUSE... BIG EFFECT



Here's an interesting case of small cause—big effect! "Small cause" is the inexpensiveness of Attapulgus Fullers Earths and Porocel Activated Bauxites. "Big effect" is the large number and intrinsic value of jobs these materials do for petroleum refiners.

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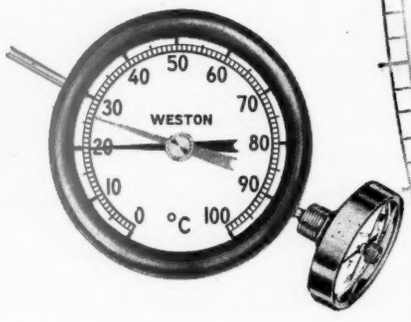

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Literature describing Weston all-metal, as well as electrical and glass thermometers, sent on request. WESTON Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey . . . manufacturers of Weston and TAGliabue instruments.

WESTON *Instruments*

continuity of operation. Under all circumstances the recovery of available aromatics is high, but it is diminished somewhat as shown in the following table at very high levels of aromatic purity:

Per Cent Purity	*Per Cent Recovery*
98	90
96	94
94	96
90	98

No problem is experienced in making specification benzene and toluene other than that a light sulfuric acid treatment is usually required to meet the acid wash specification. Not much acid is required as olefins, which cause off-test acid wash, are rejected largely to the saturate product.

The cyclic operation of the gel cases is automatically controlled. A meter in the effluent line from each case maintains the flow rate constant at any desired level. This permits the quantity of charge and of desorbents 'A' and 'B' to be controlled wholly by a cycle timer, which also keeps the operation of the six cases staggered.

The effluent is accurately and automatically cut from the saturate to the aromatic product line by an instrument developed in the Sun Oil Company laboratories. This instrument measures an appropriate property (such as refractive index) of the effluent and is adjusted to switch the product valves at predetermined times after this measured characteristic of the effluent passes through a minimum, see Fig. 3.

Investment and operating costs of an Arosorber vary with the size of the unit, the desired purity of the product, the aromatic content of the feed, the way the plant is integrated with other facilities, and other factors. The following table, however, gives taxes, maintenance, 10-year depreciation, etc.

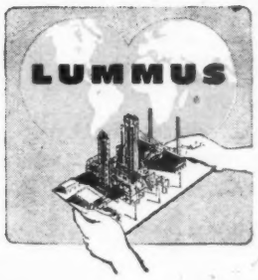
Capacity, B/D aromatics	1,000	2,000
Investment cost	$1,200,000	$1,900,000
Oper. Cost, Cents Gal. Aromatics	6½	5

Both Houdry Process Corporation and Universal Oil Products Company are being appointed as agents authorized to license the Arosorb process.

Although Sun Oil Company will couple its Arosorber with a 10,000 bbl per day Houdriformer, any of the new catalytic reforming processes could be used. The catalytic reforming operation converts naphthenes into aromatics. Suitable redistillation of the product is used to prepare aromatic-rich feed for the Arosorber. Final fractionation of the aromatic product then produces specification products.

Costs and steel requirements compare favorably with competitive processes on a per-barrel-of-product basis.

* * *



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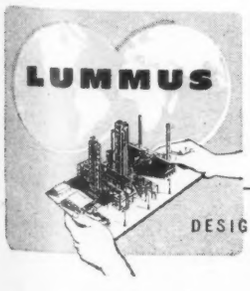

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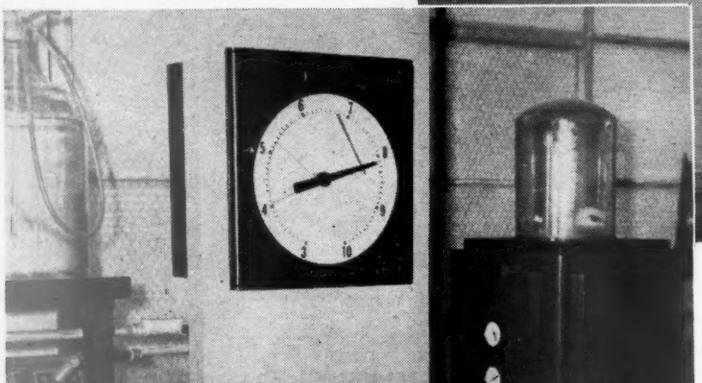
Control apparatus for cooling tower at the El Paso station, left to right: Industrial instruments conductivity bridge apparatus in bracket installation on laboratory table, control panel for Brown-Beckman PH controller, and Wallace and Tiernan gas chlorination equipment.



Station control laboratory and instrument installation.

Use of conductivity cell to improve control of water treatment at compressor stations.

Wheatstone Bridge in Cooling Tower Control

M. J. CROWLEY, JR.

THE advancement of the water treatment methods in El Paso Natural Gas Company has enabled the water engineer, not only to simplify but to improve the control of water treatment at the compressor stations. With this in mind an investigation was undertaken to improve and simplify the control of concentrations in the cooling towers by the use of the Wheatstone Bridge.

The investigations were directed along two lines: The relationship of specific conductance to make-up water treated and to make-up water untreated. Along with the above general investigations, data were accumulated on the chloride method of determining concentrations and the relationship of chlorides in chlorinated water and unchlorinated water.

The installation of the instrument had to be made at an accessible point where a representative sample would be present in the cell at the time of reading.

With the above examinations and proper installation made, it was concluded that the Wheatstone Bridge conductivity cell would accomplish its purpose. It would express the concentrations in microhms rather than in terms of concentrations equivalents. It was found in the examinations that the application of the Wheatstone Bridge made it impossible to have a definite relationship at all times between the conductance of make-up water and concentrated treated make-up water.

EXCLUSIVE

Theory of Operation

The Wheatstone Bridge conductivity cell is an instrument to measure the electrical conductance of a solution.

A solution of ionizable salts in a solvent (water in this case) will conduct a current of electricity, the negative ions being attracted to the posi-

The Author

M. J. Crowley specializes in water treating for his company, El Paso Natural Gas Company. Born at Nacozari, Sonora, Mexico, in 1925, he received his higher education at the University of New Mexico, and at Texas Western College branch of the University of Texas, and was graduated with the Bachelor of Science degree in chemistry.

tive electrode and the positive ions to the negative electrode. With an increase of ions per volume of solution (an increased concentration), the ability of this solution to conduct an electric current increases since the resistance of the solution decreases. This is because conductance, C, is equal to the reciprocal of the resistance, R, and this is measured by the Wheatstone Bridge circuit.

Fig. 1 represents the Wheatstone Bridge circuit. R_f is the fixed resistance in the circuit. R_s is the second fixed resistance in the circuit—that of the solution in question. R_1 and R_2 represent the variable resistances. In adjusting the ratio $\frac{R_1}{R_2}$ to equal the ratio of $\frac{R_f}{R_s}$ the circuit is balanced and the cathode ray tube (tuning eye) will be adjusted to its maximum limits.

An alternating current is introduced into the circuit so as to avoid a plating effect at the electrodes, E, which would vary the resistance to the circuit.

In measuring the resistance in ohms it is a simple task to calibrate the instrument scale so as to read the reciprocal of the resistance, or conductance in ohms. In operating the Wheatstone Bridge to measure the conductance of a solution it is necessary to introduce a temperature factor. The movement of ions within a solution increases directly with the temperature as does the solubility of most salts in solutions. With these variations compensation in the instrument is needed. The compensation is introduced by calibrating the resistance ratio $\frac{R_1}{R_2}$ with a shunt.

Concentration Equivalents

Water used in cooling tower operation is recirculated for economic reasons and for convenience. In circulating over and over a loss of water is necessary for heat exchange, and concentration of salts results. In figuring the concentration one guards against deposition of these salts in a tower. Four methods are used in figuring these concentrations:

1. Water metering
2. Testing chlorides
3. Analytical calculation of total dissolved solids
4. Wheatstone Bridge conductivity cell

Water Metering. This method is of prime importance because it shows exactly how much water is being used. It is of no advantage whatever in securing information as to what salts are present and whether or not they will be deposited.

Testing Chlorides. This method has been in use for some years. It involves testing the amount of chlorides in the make-up water and the amount in the cooling tower water and then figuring the ratio one to another. This method is merely a good estimation at its best.

It was found that chlorides are a universal constituent in water and are stable in high concentrations. In a tower in which treating chemicals such as phosphates, acid, and chlorine are added after make-up, this method has no way of checking for these salts. An open cooling tower will accumulate wind blown matter which will not be detected by this method.

Analytical Calculation of Total Dissolved Solids. This method is the most accurate and is probably the only way to get an absolute check on the concentrations. The time factor in this method is the defeating element. It would not be feasible to analyze the water in a cooling tower every day. A complete analysis would require from four to six hours and would involve a high cost in equipment and personnel.

Wheatstone Bridge. Three main factors favor the use of the Wheatstone Bridge conductivity cell:

a. Speed. The operation of the bridge consumes but a few minutes per day. Further, the bridge can be set up to measure and to record automatically.

b. Simplicity. The bridge is a simple instrument to operate. Installation and maintenance costs are small.

c. Accuracy. The bridge measures the total ionized particles in solution and does not require comparison with make-up results to accomplish its purpose.

TABLE 1. El Paso station conductivity log.

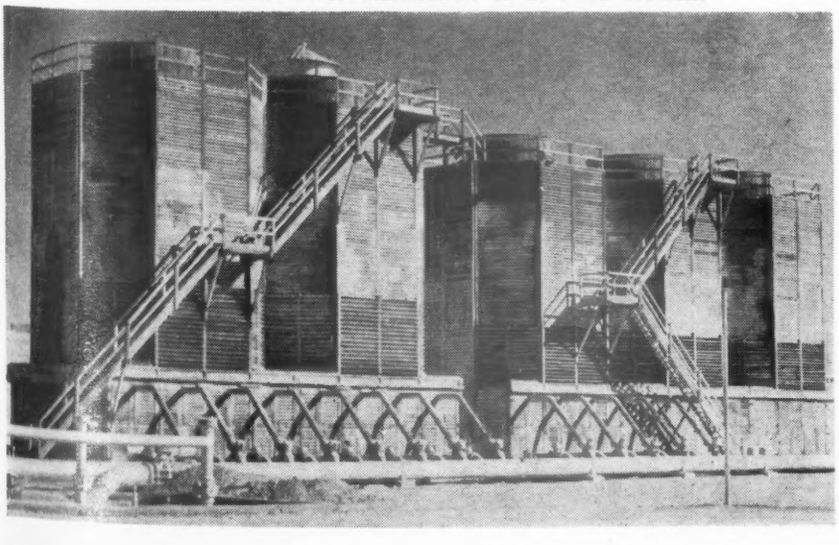
Date	Cooling tower micromhos	Make-up micromhos	Concentration chlorides	Equivalents conductance
April 10	2475	340	8.7	7.3
April 12	2800	365	9.6	5.8
April 13	2550	380	8.2	7.2
April 14	2400	350	8.5	6.9
April 15	2550*	360*	9.57	7.07
April 16	2425*	350*	9.31	7.07
April 17	2475	335	9.71	7.37
April 18	2450*	400*	no sample	
April 19	2550	350	7.0	7.2

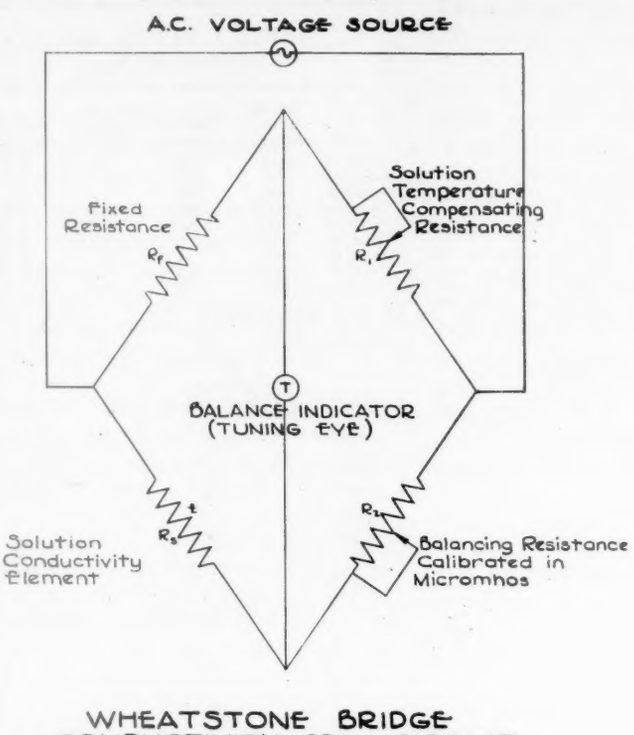
* By station personnel.
Note: Chlorides for make-up water are 61 ppm. This is an average figure.

Examinations Made

Several tests were made using the water at our El Paso station for this experiment. The task was to determine whether the Wheatstone Bridge would be accurate enough to use in the cooling system. The chloride method was used at this time. The first step was to check the concentrations for a period of seven days by the chloride method

Fluor induced-draft tower installation at El Paso Station.





WHEATSTONE BRIDGE CONDUCTIVITY CELL CIRCUIT

FIG. 1

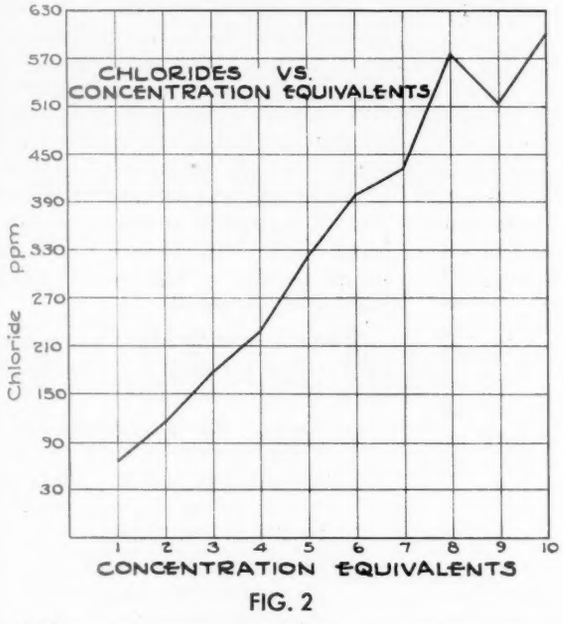
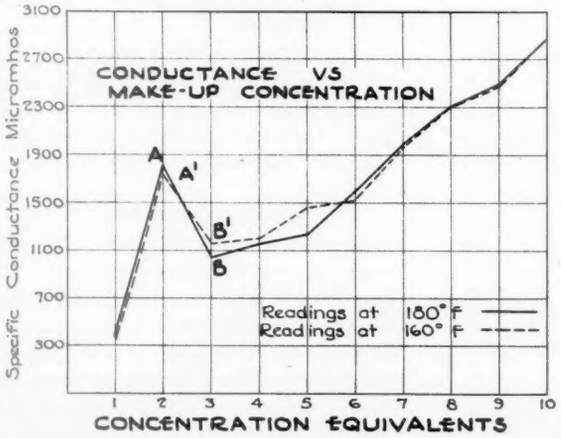


FIG. 2



← FIG. 3

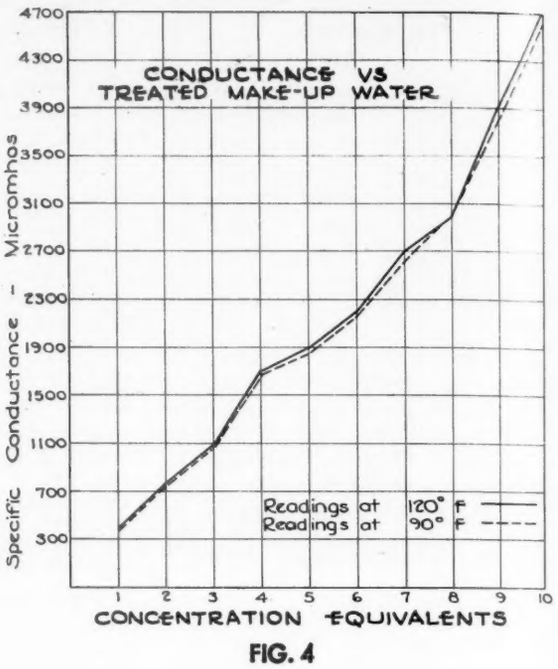


FIG. 4

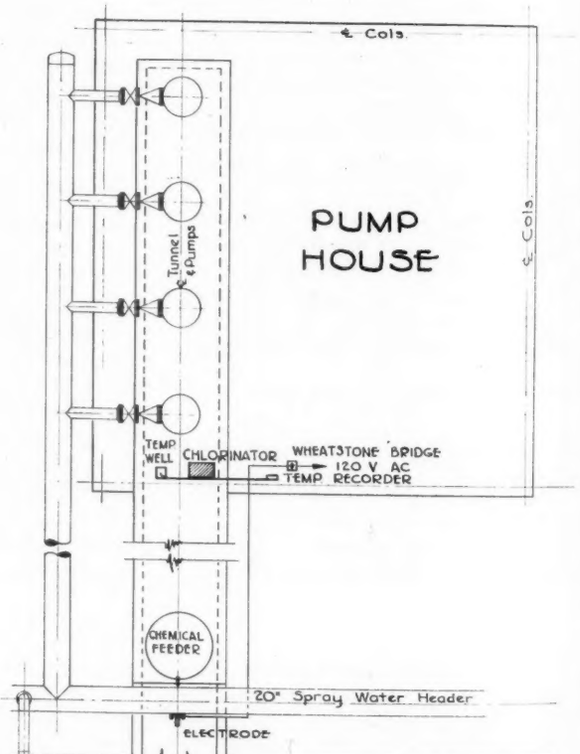


FIG. 5

and at the same time record the specific conductance for the tower water and make-up water. An examination of the results showed no direct correlation. See Table 1. It was then decided to work with both chlorides and specific conductance independently and see if there were some correla-

tion. With this plan in mind the following tests were made:

1. Variance of chlorides in chlorinated and unchlorinated water
2. Chlorides vs concentrations
3. Conductance vs make-up water
4. Conductance vs treated make-up water

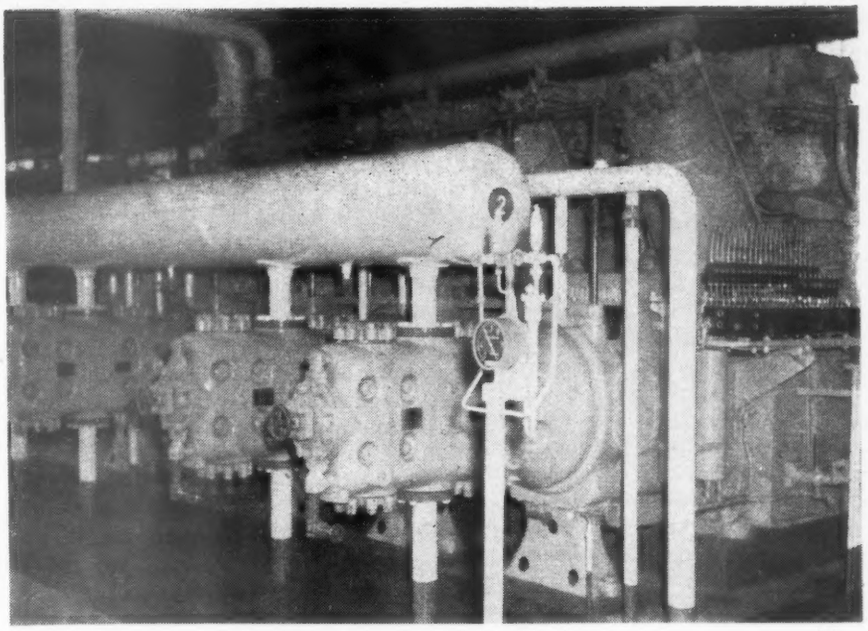
Variance of Chlorides in Chlorinated and Unchlorinated Water. In the examination of this particular problem no great amount of variation occurred. The small amount that did occur, however, was due to the reaction of the chlorine gas as an oxidizing agent. In this reaction, oxidation-reduction, the chlorine atom gains an electron and changes to a chloride ion. The test that was run was that of checking the chlorides in the cooling tower. After three days without chlorination, a second check was made after the chlorinator had been in operation for a one hour period. The results of the tests are as follows:

Unchlorinated water .....472 PPM chlorides
Chlorinated water .....488 PPM chlorides
Make-up water ..... 58 PPM chlorides
Concentration unchlorinated ..... $\frac{472}{58} = 8.1$
Concentration chlorinated ..... $\frac{488}{58} = 8.4$

The results show no appreciable change in the concentrations although a difference is shown. It may be assumed that with an increased amount of oxidizable material this difference could be of some importance. Such an increase however would be noticed first in the test for residual chlorine during operation of the chlorinator.

Chlorides vs Concentration Equivalents. In this examination it was found that the chloride content of water will not vary greatly with the respective concentrations up to a concentration equivalent of seven. (See Fig. 2.) At this point indication is given that slight precipitation is occurring. After a steep incline from concentration equivalent seven to eight, a great deal of precipitation occurs and all definite relationship is lost. The precipitation of chlorides in this amount is unlikely in a cooling tower system. Chlorides in water are usually in the forms of sodium, calcium, and magnesium salts, all of which are very soluble. The explanation of this precipitation in the laboratory test is that the chlorides were co-precipitated from solutions, or precipitated by insolubles. This may occur where a molecule will leave a solution and in the process become the nucleus upon which chloride is deposited and thus is carried from solution. In a turbulent moving system, such as a cooling tower, the chlorides will remain in solution because they are in a constant state of motion and have no chance to settle.

After several attempts in the laboratory it appeared impossible to keep the solution from forming such a precipitate. The conclusion, drawn from the general trend of the curve, was that above eight concentration equivalents the chlorides are in a soluble but stable state which can not fully be determined by the silver nitrate method. This is an assumption and was not investigated further because it was not the purpose of this research to disclaim this method but rather to show that the Wheatstone Bridge will do the same work more easily and give a way by which one



Cooper-Bessemer GMV-10 Turboflow main engine at El Paso station of El Paso Natural Gas Company.

TABLE 2. CONDUCTIVITY CELL

Analysis—make-up water El Paso station, April, 1950

A. Chemical—TDS

1. PH	9.3
P	25
M	120
cl	76
SiO_2	11
SO_4	41
Fe	0.9
Ca	34
Mg	26
	334

2. Probable at dryness — Total — (M-PPM Ca + PPM P)=223 PPM

B. Gravimetric—TDS
100 ML Sample

Crucible — Residue	48.3471
Crucible empty	48.3272
Residue	0.0199

PPM = 104 x 0.0199 = 198 ppm

C. Theoretic concentrations

Con.	PPM	Micromhos 160 F	Micromhos 180 F
1	199	355	395
2	398	1730	1800
3	597	1150	1050
4	796	1200	1150
5	995	1450	1250
6	1194	1525	1600
7	1393	1950	2000
8	1592	2300	2300
9	1791	2500	2500
10	1990	2875	2875

2. Con	Micromhos	Ppm
4–5	1.0	1.592
5–6	1.0	0.759
6–7	1.0	0.483
7–8	1.0	0.612
8–9	1.0	0.995
9–10	1.0	0.530

D. Ratio ppm to micromhos
Data from "B" and "C"

1. Con	Ppm	Micromhos diff.
4–5	199	125
5–6	199	262
6–7	199	412
7–8	199	325
8–9	199	200
9–10	199	375

3. Average for micromhos = ppm data from "D-2" cons. 5 thru 10

1 micromho = 0.676 ppm

may guard against precipitation of wind blown soluble products, and post make-up treatment products.

Conductance vs Make-up Water. This examination was made to determine what relationship existed between the salts existing in make-up water and conductance of this water at different concentrations.

Fig. 3 shows this relationship in graphic form. It will be noticed there is a sharp rise in the conductance between the concentrations one and two. Following this rise is a sharp drop indicated by line AB and A_1B_1. This drop was thought to be caused by precipitation of calcium and magnesium salts from the solution and later test showed this assumption to be correct. Following the graph on to the right, we find indicated a relatively large variation in the conductance measured at the two temperatures. This variance could be caused by the difference in the motion of the ions at the different temperatures or it could be caused by faulty adjustment in the instrument or by the ever-present human error. The curve previous to and following this area, however, tends to contradict the last two reasons. It may be safely assumed that the variance at this point of the curve is present only at definite temperatures and concentrations. The temperatures and concentrations present at this point, however, will never exist together at the El Paso station.

Proceeding further with the curve, from the point of intersection for concentration 3.5 the curve has a gentle uniform slope and an average slope of 1.4.

The data collected and calculations made from this examination are shown on Table 2. It will be noticed that a chemical analysis and a gravimetric analysis have been combined with the information of the curve to find an average figure for the part per million equivalent to a micromho. This figure was found to be 0.68.

Conductance vs Treated Make-up. The term "treated" refers to phosphate and acid treatment. The phosphate was fed to the sample to the amount of 12 ppm. The acid was fed so as to adjust the pH to a value within the limits 7.0 to 7.5. At no time was acid fed in an amount exceeding 0.8 per cent of the total volume of the liquid. In using this treatment we have tried to duplicate treatment in the El Paso station tower.

In studying the curve shown in Fig. 4 it will be noticed there is a fairly uniform slope to the curve. This slope is averaged as 1.3. Comparison of this curve to the previous curve shown in Fig. 3 will show the great effect the treatment has on the salts and the specific conductance of the solution. This effect is noticeable at three different points in Fig. 4. First, the treated curve does not have any great drop or rise. This is attributed to the fact that the addition of phosphates has bound the calcium and magnesium into a stable soluble form, eliminating precipitation. Secondly, there is no great variation in the curve of 90 F and that of 120 F. This consistency is also attributed to the treatment employed. Phosphates and acid have converted sodium, calcium, and magnesium to very soluble stable compounds. The effect of temperature in reference to their movement in solution will be more uniform on these compounds. The very erratic carbonate, bi-carbonate, and hydroxide ions have been removed in large amounts by treatment. Their removal will have a great effect on conductance of the solution. The third point is that a higher value in micromhos per concentration is noticed. This is due to the lack of precipitation in the treated sample.

From the previous tests it is shown that it is not plausible to use the conductance ratios of tower and make-up, as the chloride ratio is used at the present time. The recommendation proposed is that instead of using a concentration equivalent figure for limits of control to subsequently use specific conductance readings for the limits. An example is that control proposed for the El Paso station. Limits for concentration equivalents at present are 8 to 10. The limits to maintain the same control by the conductance method would be 3000 to 4700 micromhos (See Fig. 4). The control within this limit would still be by blowdown and make-up addition.

Installation

It was recommended by the instrument company to install the electrodes of the instrument in the stream at an angle of twenty degrees from the vertical and facing the flow of water. This type of installation is necessary so as to have the electrode always immersed in water and measuring the conductance of a representative sample of the tower at all times. Two installations were made at the El Paso station.

First Installation. This installation was made April 10, 1950 at the point of the temperature well shown in Fig. 5. It will be seen that the electrodes were in the flow of water immediately behind the Calgon feeder. In this position it was not measuring a representative sample. In this position the electrode was in a stream of water which had a high concentration of phosphate (Calgon). It was found on inspection that these phosphates were plating out on the electrode and wiring. This coating was inhibiting the correct measurement by having this film gather on the electrode hence causing a resistance to flow of current.

Second Installation. This installation is as shown on Fig. 5. This installation was made on April 25, 1950 and is in use at the present time. The electrodes are fitted to a plate which is welded to the water header. The wire from the electrodes to the instrument is encased in conduit. With the electrodes previous to the phosphate feeder this will eliminate deposition of phosphate on the electrodes and give a representative sample of pit water.

The temperature obtained in both installations is read from a recording type thermometer installed in the pump house. This instrument is not in use as a recording instrument but rather as a direct reading type.

Conclusion

In the above discussion it has been my purpose to show how the Wheatstone Bridge conductivity cell can be used in the measurement of dissolved solids in cooling tower water. The operation of the instrument is simple in comparison to the use of casseroles, burrettes, and reagents employed in the chloride method. The instrument shows its accuracy because it measures all salts in the tower whether due to make-up water, treatment, or added foreign matter. The instrument will prove satisfactory if the recommendations stated are fulfilled and if the personnel at each station is correctly instructed in its function and operation.

I wish to express my appreciation for the help and cooperation given to me by everyone connected with this project.

* * *

Shell Develops New Grease

A new extreme-pressure grease for lubrication of aircraft gears and actuators at temperatures ranging from 65 below zero to 250 above has been developed by Shell Oil Company. According to J. S. Harris, manager of Shell's aviation department, the lubricant, called Aeroshell Grease 7, is designed to insure fast, smooth action of gears, actuator screws and other parts of these units where design requires the use of a single grease.

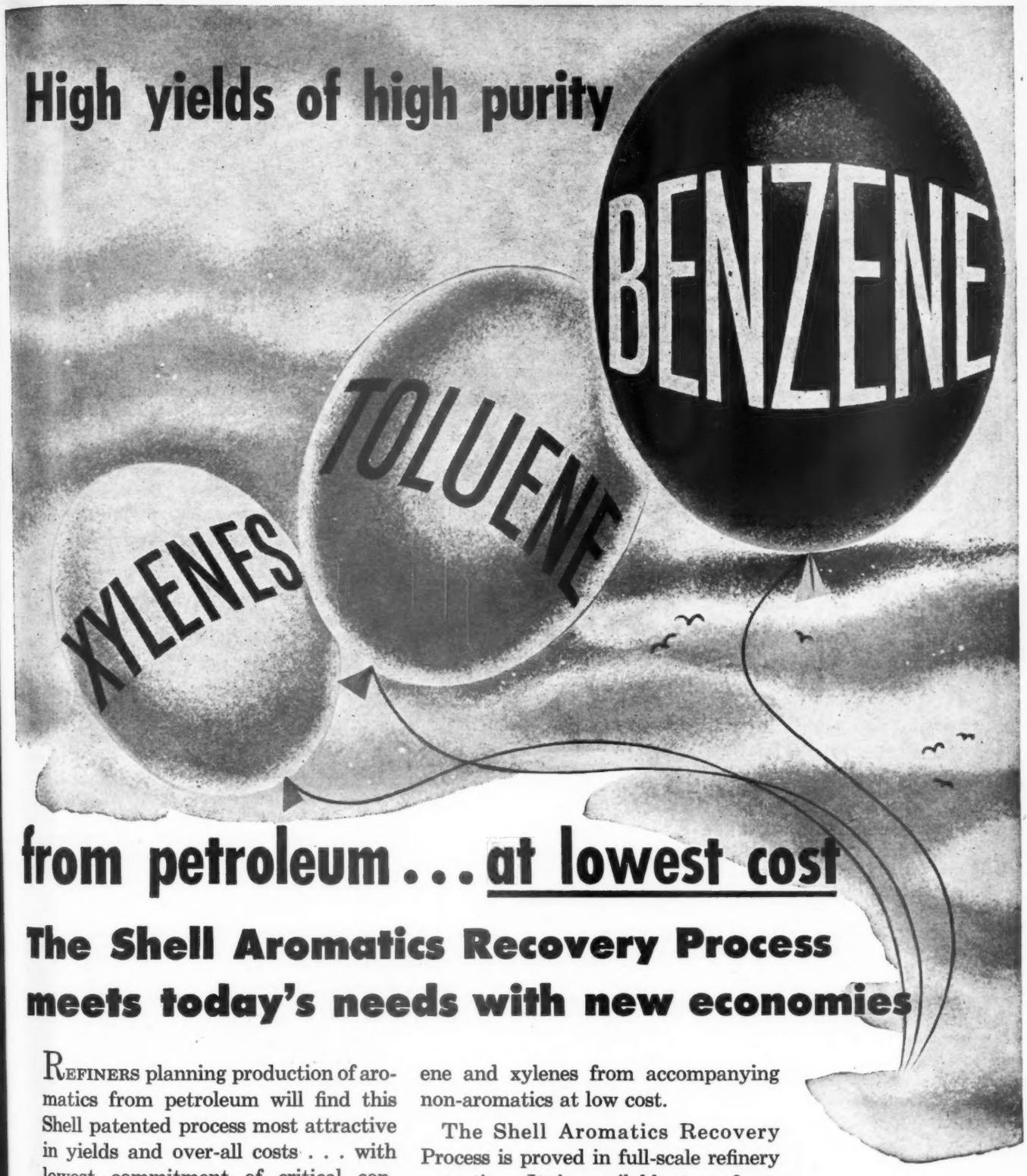


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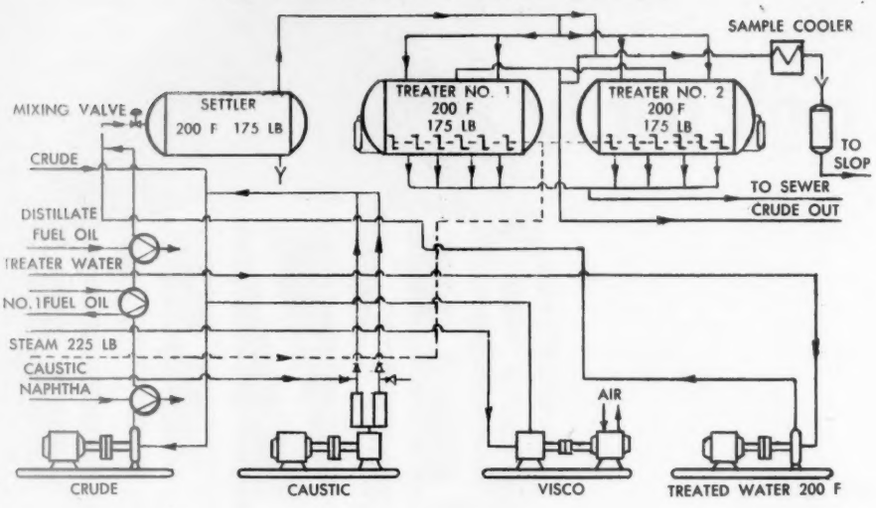
FIG. 1. ELECTROLYTIC CRUDE DESALTER



DESALTING CRUDE OIL

Construction costs run $6 to $10 per daily barrel capacity; operating costs vary from $3-plus to little more than $4 per 1000 barrels treated

Part 1 by Arch L. Foster*

Part 2 by Refinery Staff,
Socony-Vacuum Oil Company, Inc.
Trenton, Michigan

PART 1

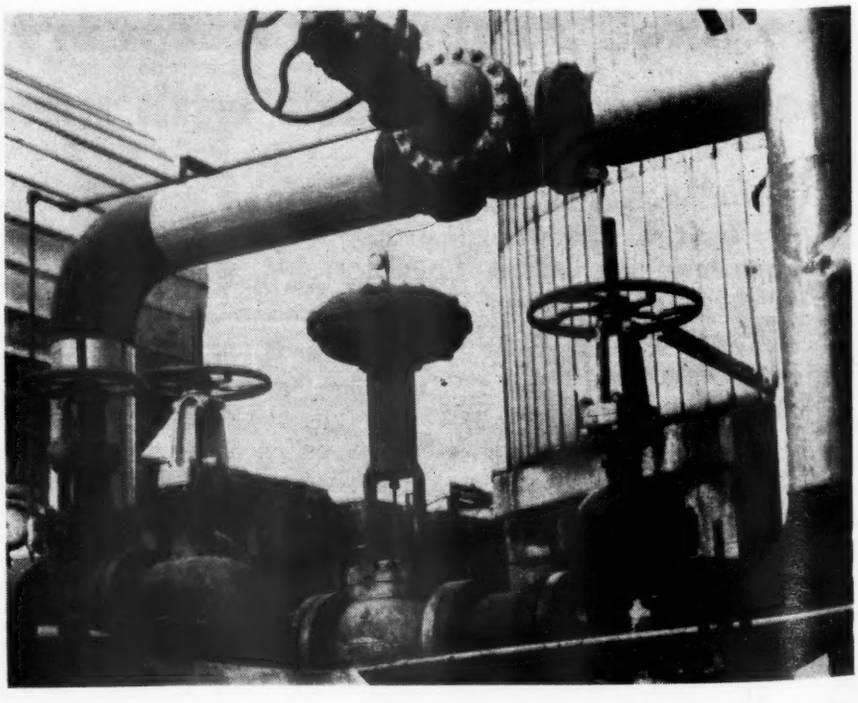
THE operation of removing inorganic substances from refinery charging stocks prior to distillation has become widespread in the past 15 years. A recent development in the art has extended the operation to a large variety of crudes whose inorganic content was so low as to make justification of the operation very difficult. All the well known processes consist of washing the oil with water in an attempt to dissolve out the inorganic matter and then subjecting the oil and water mixture to some dehydrating process to get the water out of the oil before further processing takes place. This dehydrating step is really the expensive part of the operation. The various dehydrating methods include settling, running over gravel beds, chemical demulsification and electrical separation.

*Editor, Refining and Gas Processing.

In general, these processes were set up to function individually. Occasionally, a small amount of demulsifying chemical was used with the electrical separators, but only as a last resort, and for the purpose of handling a temporary condition. In no case was an electrical unit set up to assist a chemical or settling unit. The recent practice has been to design and build combinations of the above processes, using two or three together as might be required. It has been found that if the demulsifying and de-stabilizing power of the chemical is combined with the scrubbing action of the gravel bed and the dehydrating action of the electrostatic separator, a very economical and effective system can be built. These systems have great flexibility in that a variety of crudes can be run through the same plant without making any adjustments in operating conditions. One of the greatest drawback to chemical separation has been the tendency to carry over high percentages of water at unexpected times. Since the great majority of crude distillation units will not take more than 0.7 to 1.0 per cent water without serious disturbance, this has been a source of considerable annoyance to users of this method.

If an electrostatic separator is installed after the chemical unit, however, any water that is carried over will be removed. Since the emulsion is destabilized by the chemical, the only load on the electrical unit is the work of precipitation. Under these circumstances, the dehydrating action of the electrostatic unit is very com-

FIG. 2



plete. The water carryover from this unit is usually around 0.1 per cent by volume.

The use of the gravel bed is not very extensive, although in some instances the chemical settling vessel has been filled with gravel. When chemical demulsifiers are used, it is seldom necessary to change gravel.

When the system is deliberately designed to make use of the demulsifying action of the various chemicals available and the precipitating ability of the electrostatic unit, the whole process is cheap to build and easy to operate. At the present time, about 500,000 bbl per day are being run through these combination plants, and considerable more capacity is under construction.

Construction costs of these systems run from $6 to $10 per daily barrel capacity depending on the size of the unit and the performance desired. These costs include all foundations, pumps, piping, instruments, vessels, electrostatic separators, instrumentation, labor, etc. In other words, a 50,000-bbl plant can be installed complete for about $300,000. On smaller units, of course, the unit cost goes up.

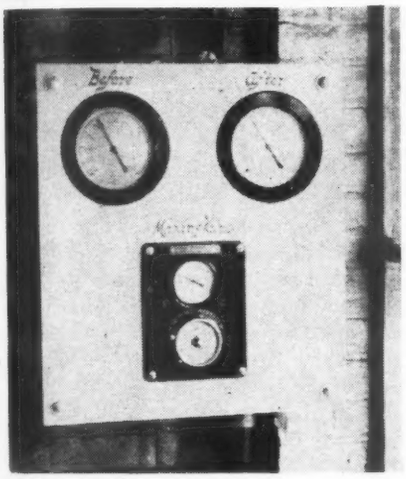


FIG. 3. Emulsifying valve panel board.

The latest type electrostatic separator designed for this service consists of a horizontal cylindrical vessel in which the precipitating electrodes are installed. The high voltage power supply to these units is totally enclosed so there is no danger of electric shock to operating personnel. This feature simplifies design of the plant in that it is possible to put walkways on top of the vessels, and install valves and control instruments at convenient points along these walkways. A further improvement is in a comparatively low voltage electrostatic field system, which reduces insulator trouble to a minimum. These improved separators are so simple that practically no maintenance is required. Some units have been in operation three years without any service whatsoever.

Operation of Desalting Systems

Some of the earliest attempts to remove salts from charging stocks consisted of adding fresh water with varying degrees of agitation and then separating the water by gravity. Very little success was obtained by this means. Most crudes, particularly those crudes under 36 API gravity, will form stable emulsions when agitated with water. Since most of the salts present in crude oil are dissolved in the residual brine left in the oil, a degree of agitation sufficient to bring about the contact between the original drops and the fresh water will usually result in emulsifying the fresh water to such an extent that separation is slow and difficult. For this reason, it became necessary to subject the mixture to some demulsifying process after the water was added. The well known electrical and chemical processes were found to be applicable and their use became general.

The application of these processes to large volumes of oil soon made the development of new techniques necessary. Previous experience on field dehydration had been usually on a small scale, particularly since the advent of proration. Furthermore, in field dehydration it was seldom necessary to operate a continuous stream at a uniform rate with no tolerance in the quality of the output. If a tank of oil proved bad after treatment, it was retreated and run the next day.

When the processes were put into refinery service, it soon became necessary to improve the efficiency of operation and the quality of the apparatus in order to meet the requirements of refinery practice. Furthermore, it was imperative that operating cost be reduced to a minimum and mechanical troubles be eliminated.

The effort to accomplish these results has developed some active chemicals and some very efficient electrical units. Experience has also shown that the inherent weakness of each process is fortunately offset by the effective principle of the other.

Chemical demulsification depends upon the characteristic of certain compounds that causes them to concentrate on the surfaces between the oil and water. These chemicals are

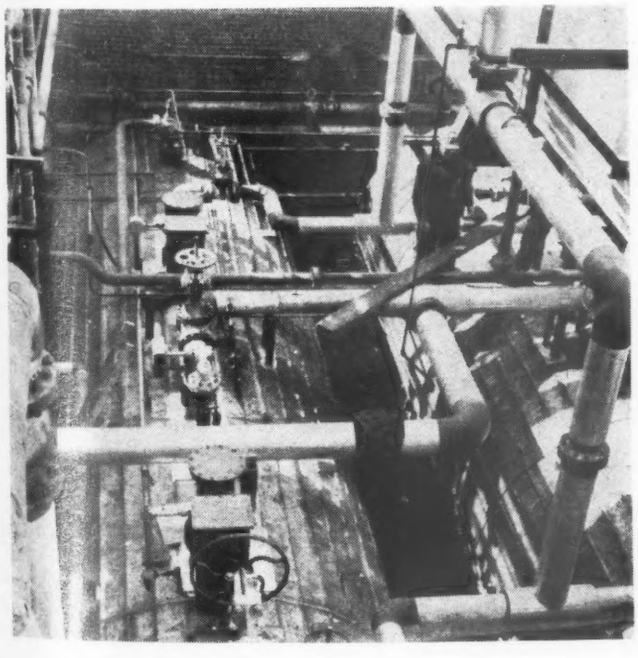


FIG. 4. View of east settler and piping.

FIG. 5. Electrode ruptured by short circuit.

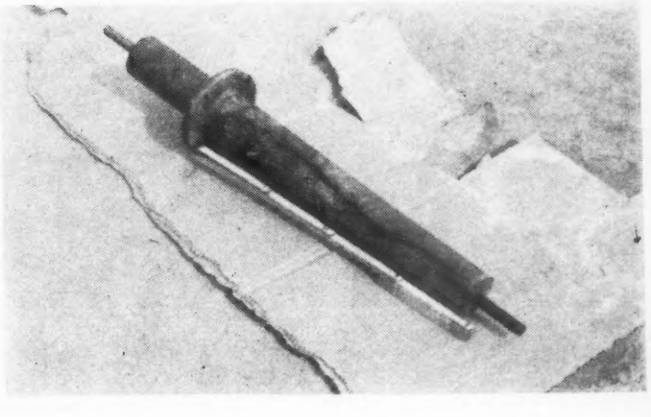
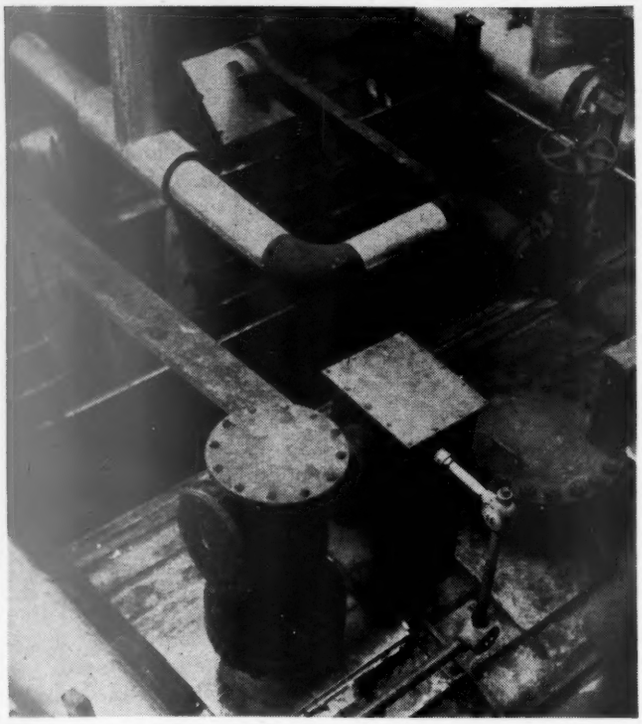


FIG. 6. Entrance bushing housing assembly and high voltage transformer.



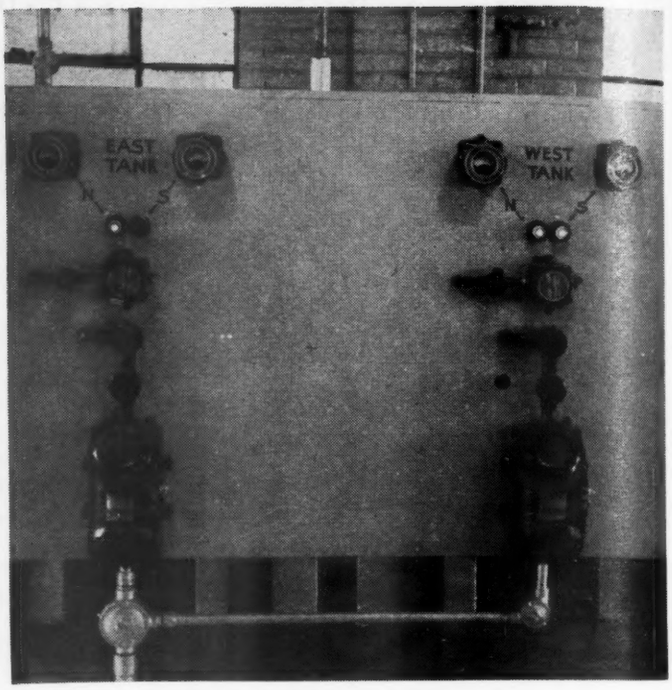


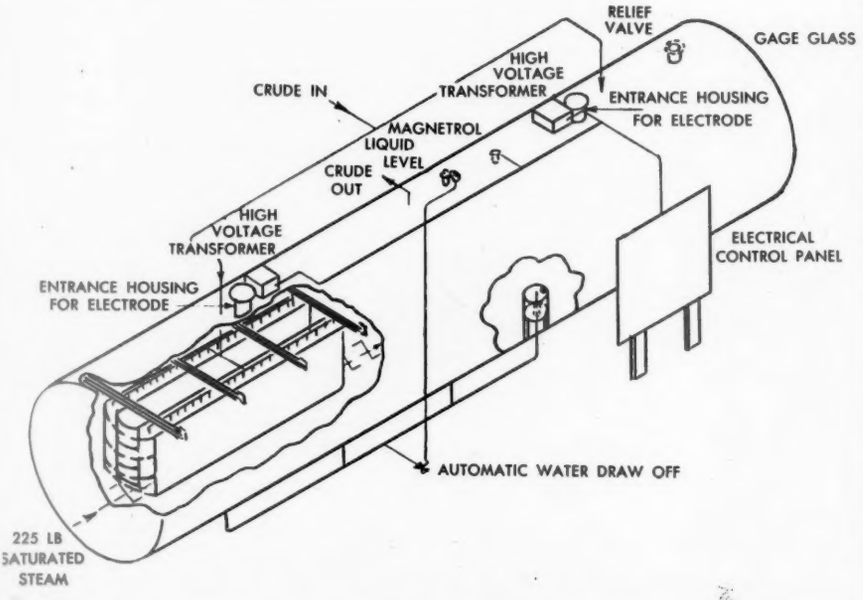
FIG. 8. Desalter electrical control panel

usually applied to the emulsion by some mixing device that brings about a rapid dispersion of the chemical throughout the emulsion. The particles of chemical then come in contact with the dispersed water drops by the random motions of the turbulent fluids. It is evident that the probability of all water drops making contact with active chemical drops is increased by breaking the chemical into smaller and smaller drops, and also by increasing the agitation. Time is also a factor in bringing about the necessary contact. The time factor sometimes makes excessive tankage necessary.

It has been found that when the mixture of dispersed chemical and emulsion is passed through a high voltage field, an attractive force is generated between the dispersed chemical and the water drops, which insures rapid contact of water and chemical. This means that the amount of chemical necessary to de-stabilize a given emulsion is greatly reduced. Furthermore, the electric forces coalesce the de-stabilized water drops with great speed, and the emulsion is in condition to separate into its components immediately. In some cases the speed of coalescence of chemical and water drops to complete separation of the emulsion is less than 3 seconds. This time is noticeably different from the 60 minutes and up required for chemical. On the other hand, the electricity alone will cause the water drops to agglomerate and subside, but a stabilized emulsion will not separate into clean water and oil unless some chemical aid is added.

These characteristics of the two systems, acting in cooperation with each other, provide the fastest demulsifying process available to date.

FIG. 7. ELECTROLYTIC DEMULSIFIER.



Salt Removal

In Tables 1 and 2 are shown typical data for the operation of Howe-Baker desalting unit in as many different installations, each in a different plant.

Noteworthy in these data are the different salt contents reported. In Table 1 two different crudes are reported, one containing 40 to 100 lb of salt per 1000 bbl, the other much worse, showing 50 to 500 lb per 1000 bbl, and up to 2 volume per cent of BS&W. The first crude is reduced to 5-15 lb per 1000 bbl, and the second attains more or less the same value, 5-35 lb per 1000 bbl.

The amount of chemicals employed

varies between 0.35-0.60 gal in Table 1 and up to 1 gal per 1000 bbl in Table 2. Where electrical treatment is employed, the secondary voltage is 16,000 a-c.

No costs were given for the desalting operation in Table 2. In Table 1 total costs for the crude with the smaller content shows to be $3.27. For the unit handling the higher salt content crude this cost is given as $4.28.

PART 2

This Howe-Baker desalting unit was built to replace a thermal-chemical unit which was installed in 1939 and which had been in constant use since that time. The operation of the old desalter was quite erratic and although it eliminated the fouling of heater tubes, it failed to minimize corrosion and the other difficulties incident to processing crude containing 20-40 lb of salt per thousand barrels.

The Howe-Baker unit was designed to utilize the maximum possible amount of the old equipment and this objective was attained in full. The unit was constructed entirely by company men and was placed in service on April 15, 1949. Since that time, surprisingly few operating troubles have been encountered. We did have difficulty in maintaining a clear (oil free) effluent however. Studies of the operation indicated that we might possibly be producing a slight vortex action from the interface. Accordingly a cap made from 14-in. pipe was placed over the drain as shown in the sketch, Fig. 2. This is the only modification of the original design made to date. Since the date of its installation, which was December 6, 1950, we have consistently maintained a clear effluent.

The capacity of the unit is normally 24,500 bbl per stream head, although we have processed as much as 25,000 bbl per stream day without difficulty. When the new TCC unit is placed in service it is expected that the desalter will be required to process 28,000-28,500 bbl per stream day.

Typical analyses of the raw crude for the past seven months are given below. These averages were obtained from daily operating records.

	Incoming crude	
	Average B. S. & W. %	Average salt content lb/M Bbl
December, 1949..	0.15	56
January, 1950....	0.10	61
February, 1950...	0.11	64
March, 1950.....	0.12	63.4
April, 1950.....	0.34	70.4
May, 1950.....	0.20	67.3
June, 1950.....	0.15	55.0

TABLE 1. Operating data, Howe-Baker desalting units.

	Unit #1	Unit #2
Design capacity of unit (B/D)	35,000	35,000
Typical analyses of raw crude		
Gravity (°API)	32—38	30—32
Salt content (ptb)	40—100	50—500
BS & W (Vol %)	0.1—0.5	0.2—2.0
Electrical conditions		
Voltage on desalter field (A.C.)	16,000	16,000
Treating conditions		
Water added (Vol % on crude)	4—6	4—6
Caustic added (gal/1000 bbl)	.....	3.5
Demulsifiers added (gal/1000 bbl)	0.35	0.6
Operating conditions		
Crude flow (B/D)	50,000	35,000
Treating temperature (F)	225	225
Treating pressure (psig)	60	60
Pressure drop across mixing valve (psig)	15—25	10—20
Degree of desalting and dehydration		
Salt content (ptb)	5—15	5—35
BS & W (Vol. %)	0.1—0.2	0.1—0.3
Dehydrating desalting costs ($/1000 bbl crude)		
Chemical costs ($/1000B)	$0.63	$1.29
Total "Out-Of-Pocket" operating costs ($/1000 bbl crude)	$3.27	$4.28

TABLE 2. Typical operating data, desalting unit, Baton Rouge. (Esso Standard Oil Company)

Capacity of unit, B/SD	18,000
Raw crude	Olla
Type	Sweet, intermediate base
Gravity, °API	30
Salt content, ptb	60—70
BS & W, vol %	0.1—0.2
Electrical conditions	
Primary voltage	440
Phase	3
Secondary voltage	16,000
Phase	1
Treating conditions	
Water added, vol per cent on crude	6—7
Demulsifying chemical rate, qts/1000 bbl crude	1—1.5
Other chemicals	None
Operating conditions	
Temperature, F	200—220
Flow rate, B/SD crude	15,000—19,000
Mixing valve pressure drop, psi	15—18
Desalted crude	
Salt content, ptb	5—7
BS & W, vol %	0.1—0.2

FIG. 9. Settling tank and west demulsifier.

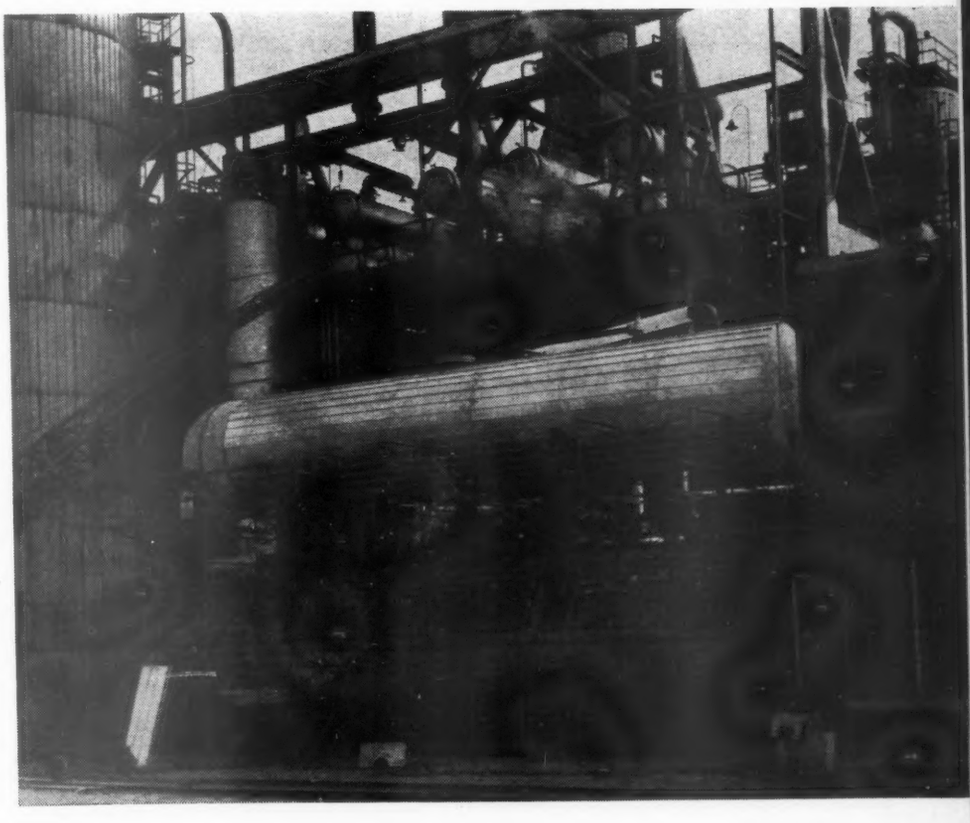


Fig. 1 indicates schematically the flow through the Howe-Baker unit. About 0.48 gal of 30 deg Be caustic soda and .22 gal of Visco per hour are injected into the cold crude stream when it is flowing at the rate of 1000 bbl per hour. This mixture is heated by exchange to a temperature of about 200 F.

Sufficient pressure to prevent vaporization is maintained on the system. About 7 per cent by volume of 200 F water is injected into the crude and the combined mixture is passed through an emulsifying valve (Mason-Neilan No. 37, diaphragm control valve). The pressure drop across the emulsifying valve is indicated on a panel board in the desalter control room. This pressure drop setting is critical in the operation for, if the dispersion is too fine, a large amount of permanent emulsion will be formed; whereas, if it is insufficient, the salt particles will fail to mix with the water and a poor salt removal will result. After the emulsifying valve, the crude mixture flows into a preliminary settling vessel where a portion of the water is withdrawn with whatever salt it has picked up. The crude mixture then splits into four parallel streams and flows into the electrolytic demulsifiers. Each demulsifier unit is a 10 by 40 ft horizontal vessel containing two sets of electrodes which carry a potential of 16,000 volts.

One plate of each set of electrodes is grounded through the crude inlet header. The other plate is charged by a high voltage transformer. The current path from the transformer to the plate is through a conductor enclosed in a neoprene entrance bushing. The electrical power rack is located in the desalter control room. The current required for the four sets of plates runs about 25 amp. An automatic water draw off system on each demulsifier consisting of a Mason-Neilan internal mounted liquid level controller for liquid interface service with a Mason-Neilan No. 38 diaphragm control valve is provided. Two safety devices are also provided. One is a magnetrol switch that cuts the electrical circuit should the liquid level in the demulsifiers recede below a safe working level. See Fig. 2. The other is an alarm system located in the desalter control room. As the water and emulsion layer build up between the plates current consumption is increased due to the decreased resistance of the fluid between the plates. This causes a dimming of the lights. A maximum current consumption of 45 amp turns the lights off and occurs when the plates are completely immersed in water. The desalted crude from the demulsifiers is further heated by heat exchange and is then charged to the crude heater.

This desalted crude had the following B. S. & W. and salt contents, which when based upon the salt content of the incoming crude gives the indicated salt removal.

	Desalted crude		
	Average B. S. & W. %	Average salt content lb/M bbl	Salt removal %
December, 1949..	0.31	18.0	68.0
January, 1950....	0.18	11.0	82.0
February, 1950...	0.29	11.9	81.4
March, 1950.....	0.15	14.5	77.1
April, 1950.....	0.35	21.0	70.2
May, 1950.....	0.24	12.5	81.4
June, 1950.....	0.13	11.5	80.1

The estimated cost of desalting crude in our installation is as follows:

	Cost/lb	Quant./M bbl	Cost/M bbl
Caustic soda	2.46c/lb	0.92 lb	$0.023
Steam	67.30c/M lb	600 lb/hr	$0.404
Demulsifying chemical (Visco)	2.22/gal	.219 gal	$0.486
Treated water	20c/M gal	2960 gal	$0.592
Electricity[1]	1.071c/KWH	25 KW	$0.268
Labor[2]	.....	.....	.....
Maintenance	$516.00/Mo.	.....	0.68.8
Royalty	.....	None	.....
Depreciation 72.500 at 5 years	.....	.....	$1.605
Product loss	.....	Undeterminable	.....
Total estimated desalting cost — $/M bbl	.....	.....	$4.066

[1] Does not include crude pumping cost since charge pump would develop essentially the same pressure regardless of whether desalter was operated or not.

[2] Does not include labor as available operator occasionally checks the performance. The unit should not normally require the attention of an additional operator.

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HOUSTON . . . NEW ORLEANS

Edmonton Refinery Begins Operation

Bringing to a total of $24,000,000 its capital investment in Canada's Alberta Province alone, the British-American Oil Company Limited formally opened its just completed refinery occupying a 60- at Edmonton.

The contract for the design, procurement and erection of Edmonton East's complete combination unit was executed by the Canadian Kellogg Company Limited.

The processing plant is a comprehensive unit embracing crude topping, delayed coking, catalytic and thermal cracking, and gas recovery divisions, together with treating facilities for white products. It will handle 5200 bbl (182,000 gal) of crude oil per day.

Because of abundant supplies of coal and natural gas throughout Alberta, the delayed coking process was especially chosen for inclusion in the overall set-up, enabling the plant, as it does, to produce a minimum of bunker fuels for which there is relatively slight demand in that Province. The topping section removes quantities of light straight-run naphtha, turpolene, kerosine, and diesel, for blending into finished products after chemical treatment. The crude residue is then passed through the coking section, where it is cracked into gas, gasoline, cycle oils, and coke.

As the crude processed comes from oilfields in the district (chiefly Redwater), oil storage tankage comparable to that at refineries where crude has to be brought in by ship or rail has been restricted thus far to the 460,000 bbl requisite only for use in processing and in storing finished products.

Two Foster-Wheeler boilers, each capable of producing 60,000 lb of steam per hour, have been installed, together with a complete boiler feed-water treating system, including boiler-feed pumps.

—H.C.P.

Your questions on refining and gas processing problems answered here. Send yours in today!

The Technical Forum

Heat Transfer Coefficients

Q Please show by equations the most practical method or methods with all variables included of how to determine heat transfer film coefficients for both condensers and evaporators on both shell and tube sides.

J. D. H.

A For condensing vapors the heat transfer coefficient may be calculated from the following Nusseult equations.

Horizontal tubes:

$$hm = 0.73\left(\frac{k_f^3\,\rho_f^2\,g_L\,\lambda}{D\mu_f\,n\,(\Delta t)_m}\right)^{0.25} \quad \ldots\ldots\ldots (1)$$

Vertical tubes:

$$hm = 0.94\left(\frac{k_f^3\,\rho_f^2\,g_L\,\lambda}{L\,\mu_f\,(\Delta t)_m}\right)^{0.25} \quad \ldots\ldots\ldots (2)$$

hm = mean value for h, $\frac{\text{Btu}}{\text{hr ft}^2\,^\circ\text{F}}$

D = diameter, ft

ρ_f = density of liquid film

g_L = acceleration due gravity 4.18×10^8 ft/(hr)^2

λ = latent heat of vaporization, Btu/lb

k_f = fluid thermal conductivity, $\frac{\text{Btu} - \text{ft}}{\text{hr} - \text{ft}^2 - ^\circ\text{F}}$

μ_f = viscosity of liquid film, lb/hr ft

n = no. of rows in a vertical plane

$(\Delta t)_m$ = true average value of the terminal temperature differences of condensate.

In using the above equation, two points should be noted. First, the physical properties of the film should be evaluated at a special condensate film temperature rather than at the bulk temperature of the vapor and condensate. The film temperature can be calculated by the equation

$$t_f = tv - 0.75\,(\Delta t)_m \quad \ldots (3)$$

where tv = saturation temperature of vapor, °F.

Second, the above equations for calculating the coefficients assume a knowledge of the temperature differences between the vapor and wall at the terminals of the heat exchanger $(\Delta t)m$.

As this temperature difference is not known, a trial and error calculation is required. A value for $(\Delta t)m$ must be assumed and hm calculated. The value for hm is then used in the equation

$$q = hm\,Aw\,(\Delta t)m$$

$$\text{or } (\Delta t)m = q/hm\,Aw \quad \ldots\ldots\ldots (4)$$

where q = rate of heat flow, Btu/hr

Aw = area of tube wall, ft^2

An example of the use of this procedure follows:

Example 1: 45,000 lb/hr of air at 60 F are heated to 180 F in a horizontal tubular heat exchanger, condensing saturated steam at 220 F.

There are 300 carbon steel tubes in parallel. The tubes are 2.00-in. ID, 2.10-in. OD, and are 18.5 ft long. There are 5 rows of tubes in the vertical plane in the exchanger. Calculate h for the condensing steam.

$q = wCp\Delta t = 45{,}000 \times 0.24 \times (180 - 60) = 1.296 \times 10^6$ Btu/hr. Assume $(\Delta t)m$ for steam film = 2 F

3. $t_f = 220 - 0.75 \times 2 = 218.5$

In consistent units, (See nomenclature of Eqn. 1)

$\rho_f = 59.6$; = 965; D = $\frac{2.1}{12} = 0.175$

$\mu_f = 0.678$; $k_f = 0.388$; n = 5

$$hm = 0.73\left(\frac{(0.388)^3\,(59.6)^2\,(4.18 \times 10_8)\,(965)}{(0.175)\,(0.678)\,(5)\,(2)}\right)^{0.25}$$

$$= 0.73\,(7.05 \times 10^{13}) = 2120$$

$$Aw = 300 \times \frac{2.10}{12} \times \pi \times 18.5 = 3.060 \times 10^3 \text{ ft}^2$$

$$(\Delta t)m = \frac{q}{hmAw} = \frac{1.296 \times 10^6}{2120 \times 3.060 \times 10^3} = 2^\circ\text{F}$$

$\therefore$ $(\Delta t)m$ assumption is checked, and hm = 2,120 BTU/(hr) (ft^2) (°F)

Film coefficients for the cooling fluids heated inside tubes (as vapor condenses outside tubes) may be determined in the customary way: i.e.,

$$h_c = 0.023\frac{k}{D}\left(\frac{DG}{\mu}\right)^{0.8}\left(\frac{Cp\mu}{k}\right)^n \quad \ldots\ldots\ldots (5)$$

Cp = specific heat, BTU/lb °F

n = 0.4 for heating; 0.3 for cooling

G = mass velocity, lb/hr ft^2

Or, a specialized equation for the specific fluid may be obtained and used. Once the heat transfer coefficients are determined, the U_o (based on outside tube surface area) for overall heat transfer may then be computed as follows:

$$\frac{1}{U_o} = \frac{1}{hm} + \frac{L}{k\,\frac{D\text{ avg.}}{D_o}} + \frac{1}{h_c\,\frac{Di}{D_o}} \quad \ldots\ldots\ldots (6)$$

D avg. is the arith. avg. diameter of the tube, ft

D_o = outside diameter of tube, ft

Di = inside diameter of tube, ft

L = tube thickness, ft

k = tube thermal conductivity $\frac{\text{BTU-ft}}{\text{hr ft}^2\,^\circ\text{F}}$

Example 2. Calculate U_o in Example 1.

From 5, or specialized equation for air

hc = 6.00 BTU/hr ft^2 °F (based on id)

$$\frac{1}{U_o} = \frac{1}{2120} + \frac{0.05 / 12}{26 \times 2.05} + \frac{1}{6 \times \frac{2.00}{2.10}}$$

$$\frac{1}{U_o} = 0.0005 + 0.0002 + 0.1750$$

$$U_o = 5.69 \text{ BTU/hr ft}^2 \text{ °F}$$

This value may be checked, since

$$q = U_o A_o (\Delta t)m \quad . \quad . \quad . \quad (7)$$

$$A_o = \frac{2.10}{12} \pi (18.5) (300) = 3052 \text{ ft}^2$$

$$(\Delta t)_m = \frac{(220-60)-(220-180)}{\ln [(220-60)\ (220-180)]} = 86.5 \text{ F}$$

$$q = 1.296 \times 10^6 \text{ BTU / hr (from Example 1)}$$

$$U_o = \frac{1.296 \times 10^6}{86.5 \times 3052} = 4.81 \text{ BTU/hr ft}^2 \text{ °F}$$

This checks within 20 per cent.

It should be pointed out that the presence of appreciable quantities of an inert gas in the condensing vapor will significantly change the methods of calculation herein presented. When this situation is encountered the reader is referred to Colburn and Hougen, IEC *26*, pg. 1178, 1934, for the method of calculation.

Heat transfer coefficients in evaporators must be determined experimentally in most cases. At very small temperature differences, the heat transfer coefficients are of about the same magnitude as those found when heating liquids, but as temperature difference is increased, agitation of the liquid by more vigorous boiling causes a rapid increase in the coefficient. However, when a certain temperature difference (called the critical temperature difference, Δt_c) is reached, h reaches a maximum value. A small increase in Δt at this point causes a sharp drop in h, as shown in Fig. 1.

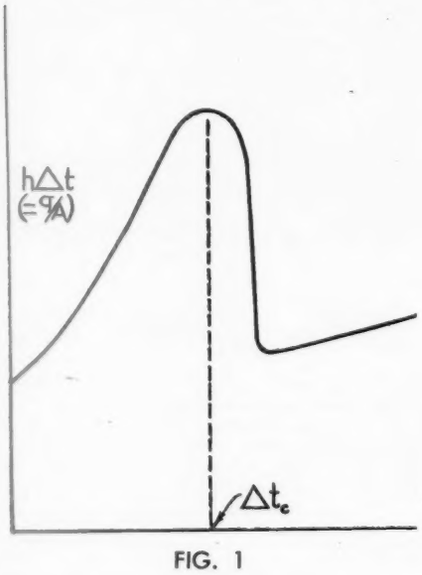


FIG. 1

This phenomenon is due to the formation of an insulating vapor film on the walls of the tube or vessel, around the boiling liquid. The evaporation temperature difference should be kept below Δt_c. Values of Δt_c for various materials may be found in Perry.*

Overall coefficients for typical evaporation problems may be found in Perry.

G. L. Farrar
A. M. Platt

*Perry, J. H., Chem. Engineers' Handbook, 3rd ed.

Greases—Worked vs. Unworked Consistencies

Q What scientific relationship exists between worked and unworked consistency of lubricating greases? Can such relationships be predetermined, and if not, how is the worked consistency assured during manufacture?

O. T. B.

A No definite scientific relationship exists between worked and unworked consistencies of lubricating greases. The Standard Method for Cone Penetration of Lubricating Grease (ASTM D 217-48) states "Unworked penetrations are affected by a number of factors which are difficult to control. They do not generally represent the consistency of greases in use as effectively as do worked penetrations."

By taking a number of factors into consideration, however, a manufacturer of lubricating grease can have reasonable assurance that a finished product within a certain worked penetration range will result by the use of certain percentages of ingredients. Such factors involve:

1. **The type of soap used.**
2. **The type and viscosity of the mineral oil in the lubricating grease.**
3. **Method of manufacture.**
4. **The temperature at which the product is finished and packaged.**
5. **The amount of milling to which the finished lubricating grease has been subjected.**
6. **The thixotropic qualities of the particular type of lubricating grease.**

The following tabulation indicates the percentages of various soaps which will, under average conditions, produce a finished lubricating grease of #2 N.L.G.I. grade (265 to 295 worked penetration).

Type of soap	Per cent required with 300 @ 100 oil	75 @ 210 oil
Regular aluminum stearate	9.0	8.5
High gel strength al stearate	7.5	7.0
Calcium tallow soap	12.0	11.0
Soda soap of tallow	11.5	9.0
Lithium stearate	12.0	11.5
Barium soap of tallow	18.5	18.0

To assure the above worked penetrations the fats must be as completely saponified as is possible. If free fat remains in the finished lubricating grease an abnormally high "break" (thinning) on working will occur.

If calcium base products are agitated for a prolonged period at temperatures below 175 F, softening will occur. Therefore, such lubricants should be packaged hot in order to maintain the desired consistency.

In the case of aluminum base lubricating greases, rapid chilling will generally give a heavier consistency than will slow cooling.

Thixotropy is the quality of a plastic material which enables it to set-up again after being softened by working or shearing. This will vary with different products, but in the main, lubricating greases made from aluminum, barium, calcium and strontium soaps exhibit greater thixotropy than do products made from lithium or sodium soaps.*

In the cast of most multi-purpose lubricating greases, which are now being marketed, milling is carried to the point during manufacture where little further break in penetration will occur even though they are subjected to several thousand strokes in the ASTM worker. Hence, the unworked and worked penetrations of such products will be of about the same magnitude.

C. J. B. & R. R. M.

*See Thixotropic Qualities of Soap-Hydrocarbon Systems by C. J. Boner, *J. Phy. and Colloid Chem.* 52, 1383-90 (1948).

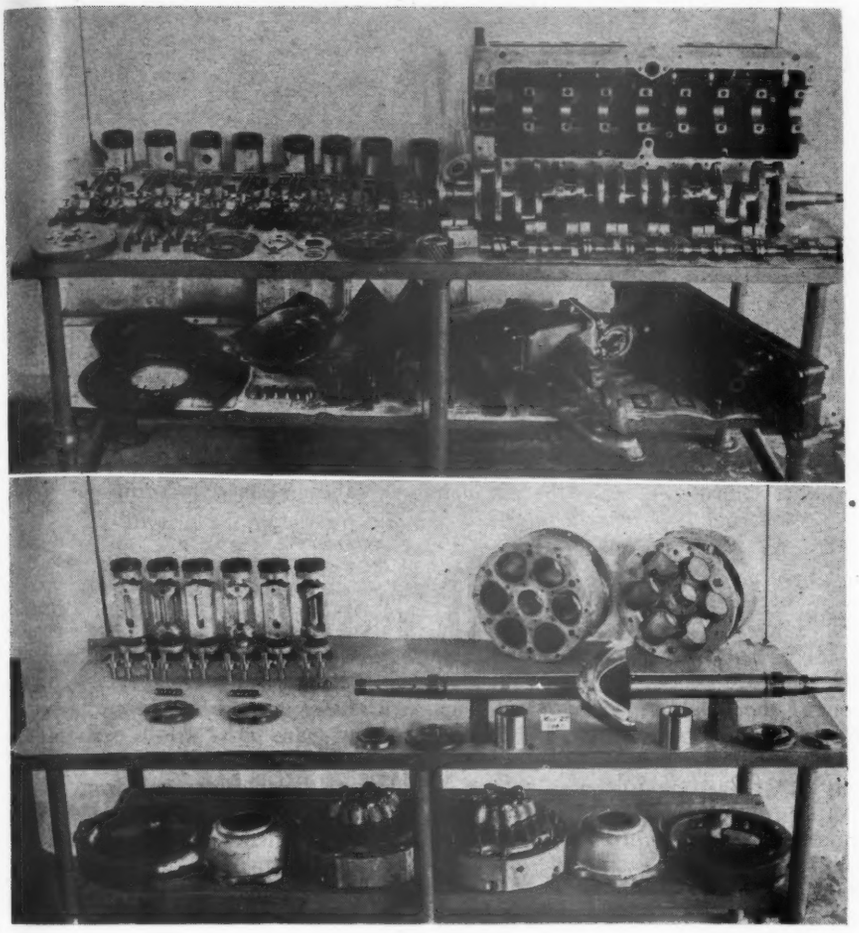
Benzene Comes from Hawaii

Stauffer Chemical Company, announced receipt at Los Angeles harbor of 300,000 gal of benzene, the first export of this commodity from Honolulu. It arrived on Union Oil Company tanker *Paul M. Gregg*.

This was the initial shipment under Stauffer's contract with Pacific Refiners, Ltd., covering all its current output. The benzene is a by product of destructive cracking of oil to gas by Honolulu Gas Company, and is piped directly to Pacific Refiners, operators of Hawaii's only oil refinery. Stauffer has erected a large storage tank and installed necessary piping at Honolulu and also arranged for storage facilities at Los Angeles harbor.

Blaw-Knox To Build Model Scale Retort

Chemical Plants Division of Blaw-Knox Company has been awarded a $333,870 contract by the Bureau of Mines for the design and construction of a demonstration-scale retort for the continuous extraction of oil from shale. To be located at Rifle, Colorado, the plant will be able to process from 150 to 400 tons of oil shale daily. It will employ a new "gas-combustion" retorting process developed at Rifle by the U. S. Bureau of Mines.



At top are the parts of an 8-cylinder engine having two-thirds the power and displacement of the cam engine.

Below are the parts of the cam engine for comparison with those from the conventional 8-cylinder internal combustion engine.

Crankless Engine Nears Production Stage

RICHARD SNEDDON*

THE so-called "round" engines, that is, engines with cylinders parallel to the main shaft, have excited just a few isolated design engineers over the past 40 years. This is rather surprising because, theoretically, they seem to hold out the enticing promise of more horse power per unit of weight, low construction and maintenance costs, long life, and wide application. Nonetheless, for some vague reason they have been denied the attention their champions believe that they deserve. Fundamentally such engines are capable of performing any of the services that are the normal functions of steam or internal combustion engines. They differ from other engines mainly in the arrangement of the cylinders and the character of the operating mechanism.

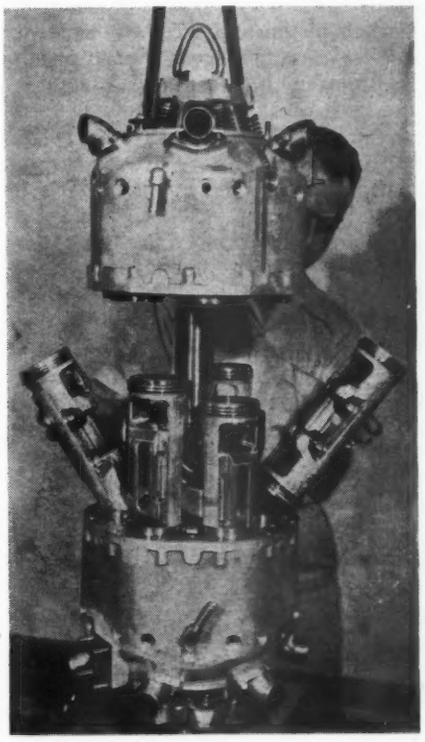
Karl Herrmann, research engineer of Glendale, California, and his associates[1], after approximately 15 years of development work, have produced a 12-cylinder cam engine that has been showing up remarkably well in performance tests. This engine was designed particularly for light planes and consequently has been submitted to the usual rigorous examination by the Civil Aeronautics Authority. As previously stated, however, it is showing up well and is believed to be adaptable to any of the normal uses of an internal combustion engine.

The completed model develops 180 to 200 hp at 1800 rpm and when supercharged has turned out 225 to 270 hp at 1500 rpm for 50 hours, without suffering any measurable wear. Maximum BMEF obtained at 1500 rpm was 220 lb. The total weight of the engine, including the starter, generator and their gears, is 286 lb. The outside dimensions of the cylinder block are 12¾ in. in diameter and the engine with its accessories is 49 in. in length.

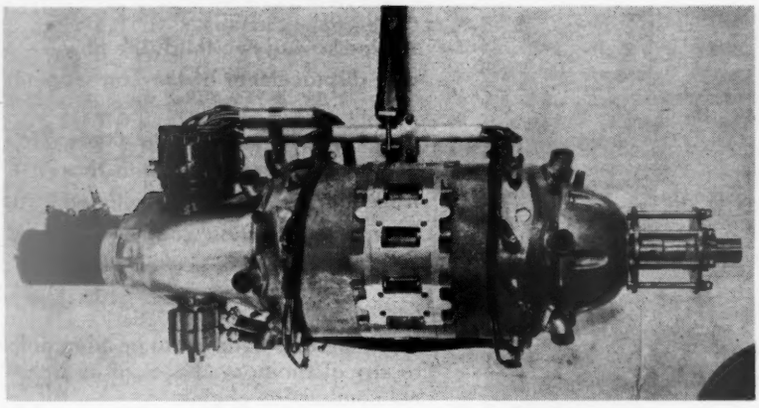
*Pacific Coast Editor.

[1]Herrmann Engineering Company.

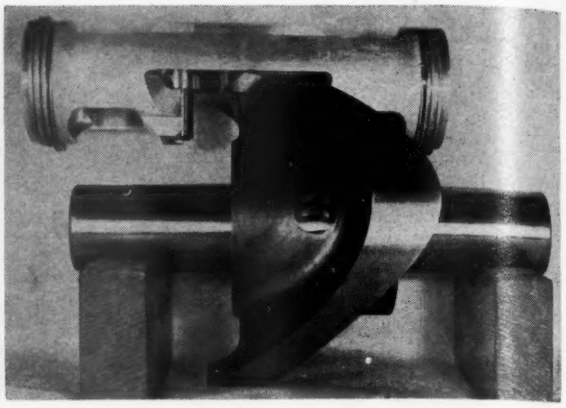
EXCLUSIVE



The process of assembly with four of the double pistons in place and the last two being set. It is all done by hand—no piston rods, connecting rods or crankshaft to worry about. Simply place two rollers in each piston, set the pistons against the cam, and lower the assembled portion into the bottom block. A center section and the upper block are then lowered over this and the two sections are bolted together.



The compactness and simplicity of design are evident here. The total length of the engine and its accessories is 49 in. The cylinder block is 12¾ in. in diameter.



The main cam is mounted on the drive shaft at the center of the engine, with one of the six pistons in place. Note roller transmits sine-wave motion from cam to piston.

Cylinders are 3¼ by 3¾ in. with a total displacement of 373 cu in.

The most interesting feature of the engine is the controlled motion of the six double-ended pistons by a cam, attached to the drive shaft at the center of the engine. Two rollers are inserted in each piston and these transmit the sine-wave motion from cam to piston. The motion that results is harmonic, and reciprocal forces simply neutralize each other, or "wash out" as the engineers say. There are no crankshaft, timing gears, or other parts to pass along the normal shocks of reciprocal action so that engine operation is characterized by low vibration, and the shaft, bearings, and related units are thus relieved of destructive friction and fatigue loads.

In a conventional 6-cylinder engine, there are three power strokes per shaft revolution and their effective turning moment on the shaft drops to near zero at the end of each power stroke. In the cam engine there are 12 power strokes per revolution. These overlap in rapid succession so that practically a uniform torque is obtained at all stages of operation, and the engine and anything to which it may be hitched is thus spared another punishing species of shock.

The design engineers claim that they have been unable to make this type of engine detonate even at a compression ratio of 11 to 1 with any fuel so far used, including a 60 octane gasoline. This, although not yet investigated fully, is believed to be due to the very effective cooling system employed. The cooling medium circulates entirely around the exhaust valve area and is so believed to maintain operation below the critical temperatures and pressures at which the detonation phenomenon occurs. The engine has a compression ratio of 9 to 1.

Indications are that fuel consumption is lower than in a conventional motor of the same horse power. That is important, but the principal attraction of the "round" engine, at least this particular "round" engine, is its simplicity. The piston assembly is easy. There are no piston rods, connecting rods, or crank shafts to worry about. All that is required is to put a couple of rollers in each piston, by hand, place the latter against the cam and lower the entire assembly into the cylinder block. Until all this is done and it is time to bolt the two main sections together, not a tool of any sort is needed.

It is interesting to note the number of component parts in a regular internal combustion engine as compared with those in the cam engine. The storage of spare parts would certainly be a much lesser problem and it seems obvious that maintenance work would also be comparatively simple. This specific application of the "round" engine principle appears to lend itself to a variety of applications. Cam engines have been designed, although not yet built, to deliver up to 1800 hp and, according to its designers, has interesting possibilities for diesel and two-cycle engines. * * *

Shell to Manufacture Nitrogen Fertilizer

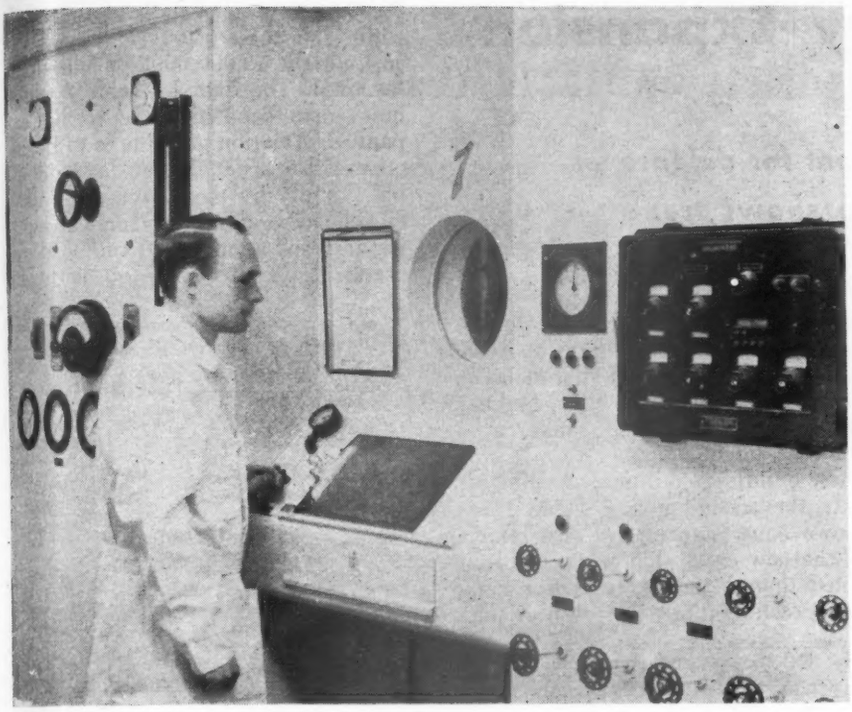
A new Shell Chemical Corporation synthetic ammonia plant for California, to be situated at Dominguez, was announced recently on the West Coast. Construction of the multi-million dollar project will begin this year with completion scheduled for late in 1952.

This new addition to Shell's petrochemical manufacturing units at Dominguez will supply nitrogen fertilizer to the farmers of California, Arizona, Oregon, and Washington. Because of the tremendous effects of its products in boosting production of foodstuffs, the plant has been certified as a necessary defense unit by the Federal Government. Raw materials for the synthesis reaction will be natural gas and air.

The fertilizer, in the form of anhydrous ammonia, is injected directly into the soil by tractor equipment or dissolved in irrigation water, which carries it to the roots of crops. California agriculturists, in pioneering this application of ammonia, have made it so successful in boosting crop yields that the demand for the product far exceeds the present supply. The direct injection of ammonia—the richest source of nitrogen—into the soil has spread from the Pacific Coast states and Arizona to many states in the South and Midwest.

Present manufacturing units at the Dominguez plant produce solvents and industrial alcohols. The new plant facilities, in addition to the nitrogen fertilizer, will produce ammonia for the manufacture of munitions, nitric acid, commercial explosives, paper pulp, and other industrial needs.

Shell Chemical also operates a large ammonia plant at Pittsburg, California. The bulk of the output is used directly as a nitrogen fertilizer to increase yields of cotton, grain, vegetable, and fruit crops.



Research technician in Shell's Motor Laboratory checks TAG six-point Celectray multiple point indicating potentiometer controller.

units are used on engine test stands for controlling the flow of additional cooling water or steam to engine jackets, oil heat exchangers, fuel heat exchangers, and comparable equipment. Two of the units are used with bearing test machines for controlling electric heaters which maintain desired temperatures.

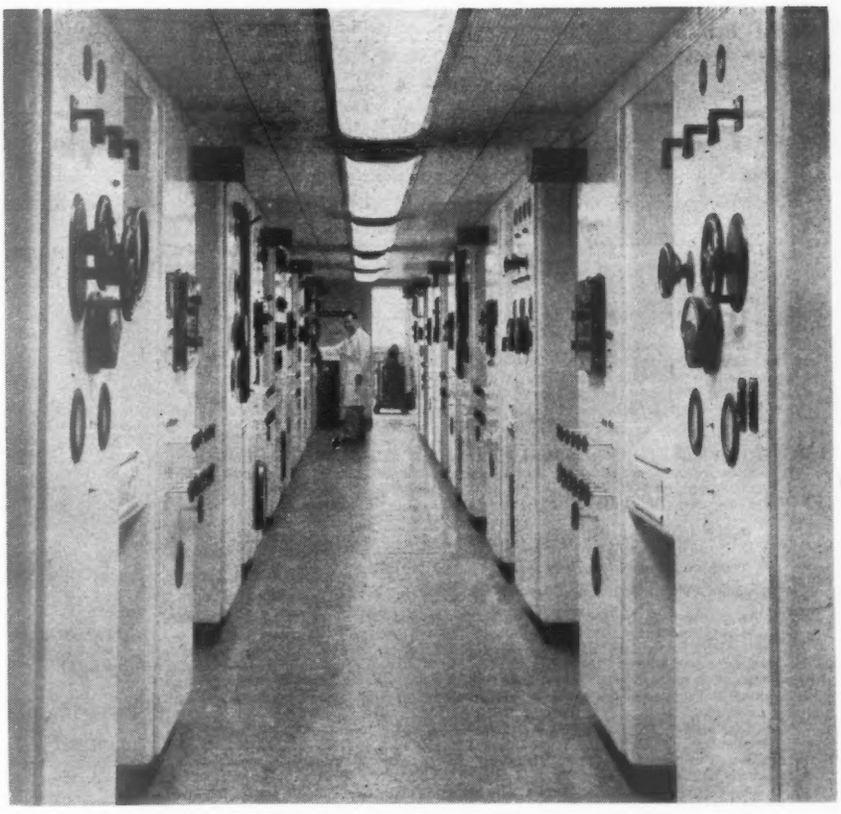
Shell conducts continual testing procedures to insure that its petroleum products meet every driving requirement. According to reports from the Martinez laboratory, which has used single unit Celectrays and other Tag instruments for many years, the multiple installation has made it possible to maintain satisfactory temperature control of test equipment with a minimum of attention from operators. * * *

Laboratory Testing Controls

A substantial increase in the number of testing units one operator can handle is the time-saving advantage of 12 multiple point controllers installed in the research department of Shell Oil Company's Martinez refinery, Martinez, California. Replacing units that were manually operated and which consequently required considerably more operator time, the battery of instruments is used for indicating and controlling temperatures in the laboratory testing of fuels and lubricants.

Known as the TAG Celectray multiple point indicating potentiometer controller, each of the 12 instruments has 6 control points, a compact arrangement available only from Taglisabue Instruments Division of Weston Electrical Instrument Corporation, manufacturer of the Celectray models. Six tests can thus be controlled at one time by one instrument, with a total of 72 tests when all 12 units are in operation. This results in appreciable savings in costs, time, and labor, while a high degree of accuracy and reliability of test results is assured.

In the Martinez installation, the TAG controllers are part of Shell's motor laboratory equipment that tests the use of oils and lubricants in engines ranging in size from one cylinder to the largest motors of trucks and tractors. Ten of the 6-point control



Battery of engine test stands includes 10 TAG Celectray controllers, each having 6 control points for controlling 6 tests at one time with one instrument.

Coastal Refinery Expansion

Huge sums to be spent for defense products processing shows trend

A $24,000,000 refinery expansion project announced by Continental Oil Company for its Lake Charles, Louisiana, plant points clearly to the continuing trend toward the increase of our refining capacity on tide water and to the rapid extension of our refining facilities.

This program, announced by Continental's refining vice president, Harold G. Osborn, was made practicable by the signing of a tax exemption certificate by Louisiana Governor Earl Long, and calls for expanding the plant's crude capacity from 12,000 bbl per day to 40,000 bbl. This newest plan followed on the heels of an earlier project, which was to spend $10,500,000 and merely double the plant's capacity. It is obvious from the wording of the announcement that the upgrading of the program is traceable directly to actual and potential military needs.

The plan calls for revamping the old 1941-built refinery and the addition of crude distillation, catalytic cracking, polymerization, and catalytic reforming units, multiplying the alkylation unit's throughput sevenfold and numerous smaller and auxiliary units. It is interesting to note that more than one-third of the total cost will be devoted to off-site facilities such as many storage tanks, tankage line systems, intermediate tanks, cargo facilities, interrefinery (Cit-Con) pipe lines, buildings, utilities, auxiliaries.

In the accompanying Table 1 are shown some informative cost details of the new expansion program. It is noted that the new Thermofor catalytic cracking unit will cost more than $4,000,000, or one-sixth of the total, while the three catalytic units will cost nearly $8,000,000, or one-third the total. The data in Table 2 show how some capacities are to be expanded. Aviation gasoline is to be increased from 560 bbl per day to 3600 bbl, mainly by the increase in alkylate capacity, along with some aromatics and isopentane from catalytic operations. Residual fuel oil is to be raised from 2100 bbl to 2847 bbl per day; diesel fuel up to 1200 bbl can be produced at the expense of other middle distillates, which capacity can be doubled by the same method. The allocation of 2250 bbl per day of raw lubricating oil feed stock to neighboring Cit-Con will aid in increasing the output of all that important plant.

Table 3 illustrates the division of products between military (defense) and civilian demands under probable future "peacetime" operations; however, more of the total output could and by implication would be devoted to defense consumption in case of "an accelerated defense program." It is noted that all aviation fuel, toluene and benzene are scheduled for defense uses, along with 25 per cent of the lubricating oil and heavy fuel oil.

The expanded plant is expected to be complete by late 1952, and most of it is to be constructed by E. B. Badger's Sons, of Boston. The remainder of the facilities will be built by Continental's enginering staff. * * *

TABLE 3. Product allocation for defense uses.

	Percentage of total production for defense usage	Volume for defense usage (B.P.C.D.)
Aviation gasoline	100	3,031
Toluene — excess	100	182
Benzene — excess	100	182
Motor gasoline	25	3,800
Distillates	25	1,360
Lubricating oil and wax (from feed stock supplied to Cit-Con)	25	560
Fuel Oil — Bunker "C"	25	240
Total		9,355

TABLE 2. Old and new product capacities.

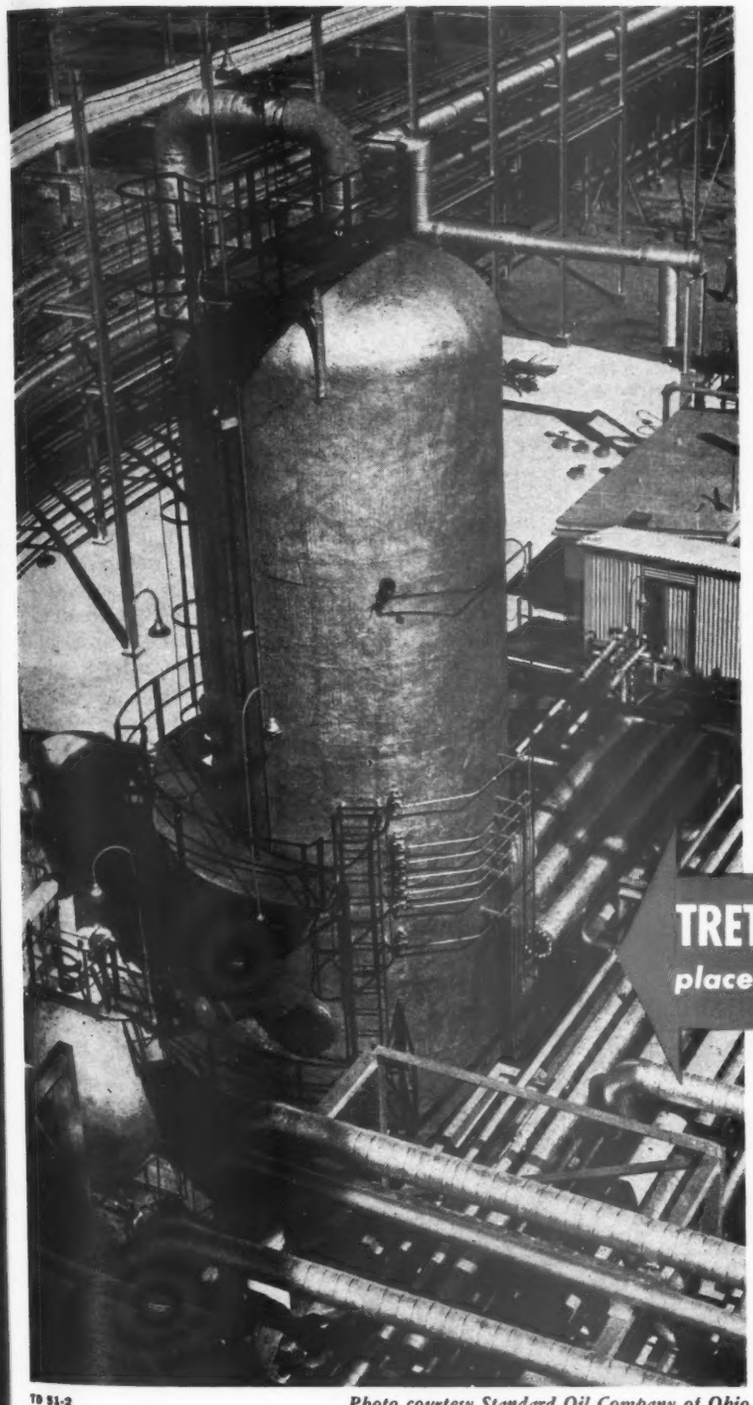
	Capacities in barrels per calendar day		
	Existing facilities	Facilities proposed to be added	Total after addition of proposed facilities
Avgas — 115/145 grade	560	3,031	3,591
(avgas components)			
Alkylate	(475)	(1,573)	(2,048)
Straight Run	0	(272)	(272)
Toluene	0	(454)	(454)
Benzene	0	(272)	(272)
Isopentane	(85)	(460)	(545)
Toluene — excess of avgas	0	182	182
Benzene	0	182	182
Motor gasoline	5,957	15,187	21,392
Kerosine	1,400	2,816	4,216
No. 2 heating oil	850	2,646	3,496
*Diesel fuel oil	1,200	0	1,200
Distillate for carbon black	600	0	600
Lub feed stock — net	0	2,250	2,250
Fuel oil	1,199	1,648	2,847
Casing-head — excess	780	—	0
Butane	0	475	475
Fuel gas (fuel oil equivalent)	904	966	1,870

* An additional maximum volume of 3130 B.P.C.D. of military diesel fuel (Mil-F-896) could be produced at the expense of the other distillates and is not totalized with the products shown in the tabulation.

TABLE 1. Cost details of Continental Oil Company's Refinery expansion program at Lake Charles, Louisiana.

A. Process Equipment		
1. Crude unit	$ 1,689,288	
2. Feed preparation	803,700	
3. Thermofor catalytic cracker	4,183,508	
4. Gas plant	2,397,742	
5. Catalytic polymerization unit	1,011,414	
6. Catalytic reforming unit	2,660,283	
7. Revisions to existing crude and thermal cracking units; crude unit includes added condensers, exchangers, pumps, compressor, piping, and interconnecting lines, and related items	270,381	
Subtotal	$ 13,016,316	
8. Revisions and additions to existing alkylation unit. Includes refrigeration compressor, reactor, rerun facilities, pumps, depropanizer, exchangers, drums, piping, added sulfuric acid storage, revisions to existing compressor, insulation and related items	571,392	
9. Feed preparation and aromatic extraction unit for catalytic reformer	1,909,299	
Subtotal	$ 2,480,691	
Total processing equipment		$15,497,007
B. Off-Site Facilities		
1. Storage tanks only, for crude, gasoline, distillates, and fuel oil, including dike, painting, and tank accessories	$ 3,092,176	
2. Line systems for tankage in item (1) above	900,923	
3. Interconnecting lines to Cit-Con	405,121	
4. Intermediate tanks only for process units — catalytic and thermal cracker charge, reduced crude and catalytic cycle gas oil in West Tank farm, including dike, painting, and tank accessories	464,689	
5 Cargo facilities — barge and tanker docks, loading and unloading lines and pumps, and related facilities	1,061,139	
6. Buildings — extensions to office, laboratory, change room, warehouse and shop, and two colony houses	281,139	
7. Utilities expansion — cooling tower system, boiler plant, water well, electrical generation and distribution, fuel gas system	1,735,966	
8. Auxiliaries — flare, blowdown and trap, fire protection, parking and roads, telephone, sanitary sewers	381,990	
Total Off-Sites	$ 8,323,143	$ 8,323,143
Grand total, process equipment and off-sites		$23,820,150

NOW EFFICIENT DESALTING IS MORE IMPORTANT THAN EVER



TD 51-2

Photo courtesy Standard Oil Company of Ohio.

. . . because efficient salt removal can be an important factor in a refinery steel conservation program.

HERE'S HOW

1 Salt carried over promotes the evolution of hydrochloric acid, a severe source of corrosion, especially in the overhead sections. Efficient desalting helps to prevent metal losses due to this kind of corrosion.

2 Salt in the crude charge causes the deposition of hard, flinty coke in furnace tubes, frequently resulting in hot spots and tube failures. Also the rigorous cleaning measures required to remove hard coke are a source of tube wear and metal losses. Efficient salt removal prevents the formation of hard coke.

TRETOLITE DESALTING *has a definite place in your steel conservation program*

Tretolite chemical desalting has proved its high efficiency in refineries everywhere. In plants with throughputs varying from 2000 b.p.d. to 50,000 b.p.d., the Tretolite process is desalting well over a million barrels daily. Salt removal percentages are in the 90 to 95% range with extremely low water, heat and chemical requirements. The flexibility of the Tretolite desalting process often permits the incorporation of existing refinery equipment in the flow scheme, holding the need for scarce new material and equipment at a minimum. Why not discuss desalting with a Tretolite engineer soon?

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Octane Numbers Show Downward Trend

Small though the average change appears to be, the trend of octane ratings is shown to be definitely downward by the July, 1951, motor gasoline survey just reported by the Petroleum Chemicals Division of E. I. du-Pont de Nemours & Co. Reporting the results of testing octane number, by both Research and Motor Methods, and tetraethyl lead content of both premium and regular grades of gasoline, this trend is established without doubt although in incidental cases slight fractional increases are noted. The trend may reflect in part at least the seasonal effect of summer, although the tendency would be to boost the rating slightly to meet hotter engine operation, and it may be due partly to the potential or actual squeeze in TEL allowance to refiners.

The report covers 696 fuel samples, purchased from retail outlets in the U. S. and Canada, of which 346 were premium fuels and 350 regular or housebrand grades. Observation of the data shows that the lowest ratings for July were in Calgary, Alberta, with an average MM for premium of 77.5, 84.4 Research. Calgary's regular gasoline averaged 74.1 MM, 78.9 Research, and El Paso, Texas, showed a lower average, 73.6 and 77.6 respectively. As is usually the case in most reports the actual octane numbers for the Western and Rocky Mountain areas are lower than for the same grades in the north and east. From Ohio east the premium grade octane rating averages 91-92, and regular fuel 85-86; along the southeast coast the ratings are approximately the same, regular grade dropping to 84 in Georgia, while Florida shows 91-86 for the two grades. All these ratings are Research Method.

Throughout the country except in the East the spread between grades is normally 7 to 8 numbers, with 5 or 6 difference in the Atlantic seaboard states. In the eastern half of Texas premium fuels show 91-92 ratings, while regular drops to 84, indicating the somewhat less severe competition in the central and southwestern areas. In fact, 82 Research is the typical rating for the central states from Oklahoma north to the Canadian line. Strangely enough the ratings on the West Coast are mostly 89-90 and 81-82, lower than East Coast ratings and lower than might be expected from that area, in view of its past performances and the crudes available. Comparative concentrations of TEL employed in the two grades do not follow consistently the octane ratings in the different localities. For example, in Amarillo, Texas, at an elevation of 3600 ft above sea level the average TEL content of premium motor fuel is only 1.48 cc per gal. At the same time the greatest amount of TEL employed in premium fuels is 2.78 cc per gal, in Vancouver, B. C., essentially at sea level. This agrees qualitatively with the fact that the greater air pressure at sea level causes higher compression pressure in engine operation and therefore requires more TEL. However, the octane rating of premium fuel at Vancouver is 89.0, only one unit higher than at Amarillo, with 88.0 average octane rating. It is quite possible that the extra amount of TEL used in Vancouver may reflect the thermal and catalytic cracking facilities of plants supplying this area which may improve the unleaded octane rating to lesser degree than is the cases elsewhere; this is, of course merely an assumption and a possible explanation.

Among regular fuels, the TEL content in San Francisco averaged only 0.81 cc per gal, varying from a high of 1.36 cc to a low of 0.31. A great metropolitan area with large refineries (SOCal, Shell and Tide Water Associated) across the Bay, this low value reflects probably both the high unleaded octane rating of the gasoline available, as well as the high cracking capacity operated by these very modern refineries. On the other hand, in an area where crude produced locally generally contains gasoline fractions of relatively low "clear" octane ratings, and where a considerable portion of the refining capacity does not operate as high a percentage of cracking capacity as is typical over most of the country, Louisville, Kentucky, shows 2.31 cc TEL per gal in regular motor fuels, which range from a high of 3.01 cc to 1.34 cc as the low. In the same locality both octane ratings and TEL content of both grades show small declines during 1951.

Motor Gasoline Survey for July 1951

	Premium			Regular		
	Octane number-July 1951		Tel content	Octane number-July 1951		Tel content
	Motor	Research	cc/gal	Motor	Research	cc/gal
Aberdeen, South Dakota	82.1	89.1	2.55	77.5	81.7	1.67
Amarillo, Texas	80.2	88.0	1.48	76.2	80.0	1.24
Atlanta, Georgia	82.5	91.2	1.84	79.9	84.5	1.77
Bakersfield, California	83.5	89.1	2.43	76.2	80.2	1.41
Baltimore, Maryland	82.2	92.4	1.80	79.3	86.1	1.30
Boston, Massachusetts	83.2	92.0	1.67	80.1	86.1	1.36
Calgary, Alberta	77.5	84.4	2.41	74.1	78.9	1.81
Casper, Wyoming	79.9	88.2	1.32	75.3	81.0	1.14
Charlotte, North Carolina	83.0	91.8	1.77	79.5	84.9	1.67
Chicago, Illinois	81.9	89.4	1.91	77.5	82.6	1.54
Cincinnati, Ohio	82.5	90.9	2.46	78.6	84.6	1.90
Cleveland, Ohio	81.8	90.6	1.72	78.8	85.8	1.17
Columbus, Ohio	81.3	90.6	2.40	78.8	85.0	1.71
Corpus Christi, Texas	83.7	91.5	1.91	79.6	84.4	1.83
Dallas—Fort Worth, Texas	82.4	91.1	2.11	77.9	83.5	2.04
Denver, Colorado	80.8	88.3	1.54	75.7	80.0	1.22
Detroit, Michigan	82.2	90.8	2.04	78.4	84.7	1.32
El Paso, Texas	78.2	85.2	2.74	73.6	77.6	
Great Falls, Montana	80.5	89.9	2.73	75.5	81.9	1.93
Houston, Texas	82.9	91.6	2.04	78.9	84.4	2.10
Indianapolis, Indiana	81.4	89.6	2.09	77.7	82.4	1.87
Jacksonville, Florida	81.8	91.2	1.75	79.8	85.7	2.06
Kansas City, Missouri	81.1	88.7	1.38	77.9	82.2	1.83
Little Rock, Arkansas	82.5	90.8	1.85	78.8	5	1.29
Los Angeles, California	81.0	89.7	1.91	75.7	83.1	2.03
Louisville, Kentucky	82.5	90.0	2.50	79.9	81.9	1.44
Memphis, Tennessee	82.1	90.2	2.11	79.1	83.	2.31
Milwaukee, Wisconsin	81.4	89.8	1.97	77.2	83.4	1.83
Minneapolis, Minnesota	81.7	88.8	2.13	77.9	83.0	1.58
Montreal, Quebec	81.3	89.6	1.63	79.4	81.7	1.74
Nashville, Tennessee	81.4	89.7	1.75	78.1	85.0	1.62
New Orleans, Louisiana	82.2	90.2	1.84	77.6	83.4	1.81
New York, N. Y. (Metropolitan Area)	83.5	91.8	2.11	80.0	83.4	1.38
Omaha, Nebraska	81.2	88.4	1.85	77.8	86.2	2.01
Philadelphia, Pennsylvania	81.8	92.0	1.68	79.4	81.8	1.36
Pittsburgh, Pennsylvania	82.2	91.5	1.92	79.5	85.8	1.53
St. Louis, Missouri	81.3	88.8	1.59	77.2	85.7	1.93
Salt Lake City, Utah	80.9	87.9	1.70	74.3	81.9	1 44
San Francisco, California	81.3	90.1	2.06	75 .3	79.4	0 89
Seattle, Washington	81.6	90.1	2.21	75.9	80.9	0 81
Shreveport, Louisiana	83.5	90.5	2.32	79.0	81.1	1.41
Spokane, Washington	82.0	89.5	1.89	76.0	84.0	2.05
Toronto, Ontario	80.8	89.4	1.62	79.2	82.0	1.51
Tulsa, Oklahoma	82.3	89.1	1.81	78.8	85.1	1.62
Vancouver, British Columbia	82.1	89.0	2.78	79.9	82.0	1.67
Wichita, Kansas	80.0	87.8	2.34	77.7	83.1	2.03
Winnipeg, Manitoba	80.3	87.8	2.56	77.7	81.1	2.08
		Average	2.005		83.2	1.67
					Average	1.637

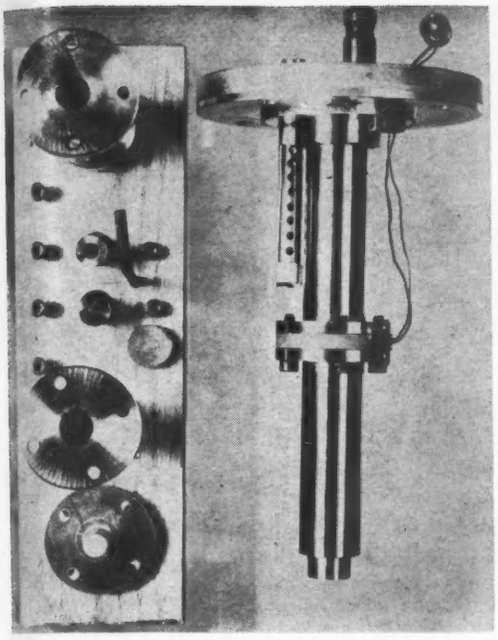


FIG. 1. Major elements of the McKee Worker-Consistometer. A set of unassembled parts is shown at left; assembled unit at right.

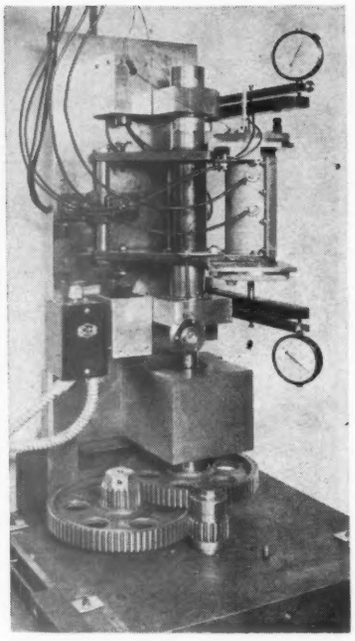


FIG. 2. Front view of screw-operated worker-consistometer.

Recent Improvements on the Grease Consistometer

Extension of working range, greater flexibility is gained by revised machine and procedure

EXTENSION of the range of working viscosities of the McKee Worker-Consistometer is made practicable by recent improvements accomplished at the U. S. Bureau of Standards, an announcement from that office states. This machine, developed originally at the Bureau, is employed to determine the effect of working on the properties of lubricating greases and has become an important instrument to the grease industry. The improved machine and procedure make it applicable also to studies of the rheological properties of rubber and rubber solutions, and to other analogous materials, the Bureau states.

Instead of using weights to apply the force to the test sample the new machine employs two constant-speed drives, one of which is cam-operated and designed for loads up to 200 lb. The other is screw-operated and has a 2000 lb capacity. Each is operated automatically, and readings of the forces may be taken at any desired intervals during the continuous working test run. The major elements are of the same design as the earlier unit. The main unit includes two coaxial steel cylinders with mating pistons and a capillary-type shearing element between them. Relative motion between cylinder and piston forces the test sample through the shearing element. Each is equipped with shearing elements with one, 10, and 50 holes through ¼-in. steel disks, holes drilled with a No. 79 wire-gage drill, or about 0.015-in. diameter.

The cam-operated unit moves the pistons back and forth and the force needed to push the sample through the capillaries of the shear element is measured by determining the force required to hold the cylinders in a motionless position. An electric heater encircles the duralumin housing and a thermocouple contacting the shear element measures the test temperature, which is controlled by a mercury-in-glass regulator. Push rods reciprocate the pistons a distance of two inches, actuated by the cam.

The mechanism overall provides a range on continuous shear rates of 200 to 100,000 reciprocal seconds, limited, for any given material, by the load capacity of up to 200 lb.

The screw-operated apparatus moves the cylinders back and forth and the test measures the force required to hold the pistons in fixed position. A steel housing attached to a steel operating yoke permits vertical motion but no rotation of the housing, which is temperature-controlled. A reversible gear motor drives this yoke, and different gear trains provide speed changes. Adjustable screws on the yoke contact push buttons operating in turn magnetic switches that reverse the motor at the end of each stroke, and all is adjusted for 2-in. travel.

A graduated dial measures the deflection of the cantilever arm of the spring held against the piston and thus indicates the force needed to force the sample through the shearing element capillaries. Five pairs of springs cover the load range up to 1600 lb. The viscosity range of this screw-operated unit is 8 times that of the cam mechanism.

In testing a grease, a sample was worked through 200 passes, then stored for 4 weeks at room temperature, tested again for 26 passes, stored for 35 weeks and tested another 26-pass period. Data showed that the change in viscosity (lowering viscosity) was marked during the first 200 passes, that is, the first test, and this change was roughly proportional to the rates of shear through the range covered. The grease appears to stabilize during storage and the later tests showed little change from the viscosity at the 200th pass. Other greases showed different results, one showing such increase in viscosity that little viscosity difference appeared in it at the two test temperatures, 100 F and 245 F. Important information has been obtained on rubber solutions, such as GR-S synthetic rubber. The flexibility and range of the unit is such that it has been used to test materials ranging from light lubricating grease up to and including 100 per cent raw rubber.

Additional data may be obtained from "The McKee Worker-Consistometer with Constant Speed Drives", by S. A. McKee, Jr., of Research of NBS, vol. 46, page 18 (1951)—RP 2170.

* * *

NEWS

Cities Service Authorizes Kellogg High Octane Unit

Cities Service has authorized The M. W. Kellogg Company, refinery and chemical engineers of New York City, to proceed with the design and engineering of two Fluid hydroforming units. Both new plants will be large-capacity units. One, situated at Lake Charles, Louisiana, will process more than 800,000 gal daily, while the other, at East Chicago, Indiana, will handle about half this volume.

Announcement of these two major plants, comes within a month after Kellogg's disclosure of the commercial process itself, while the first commercial plant is still on the drawing boards.

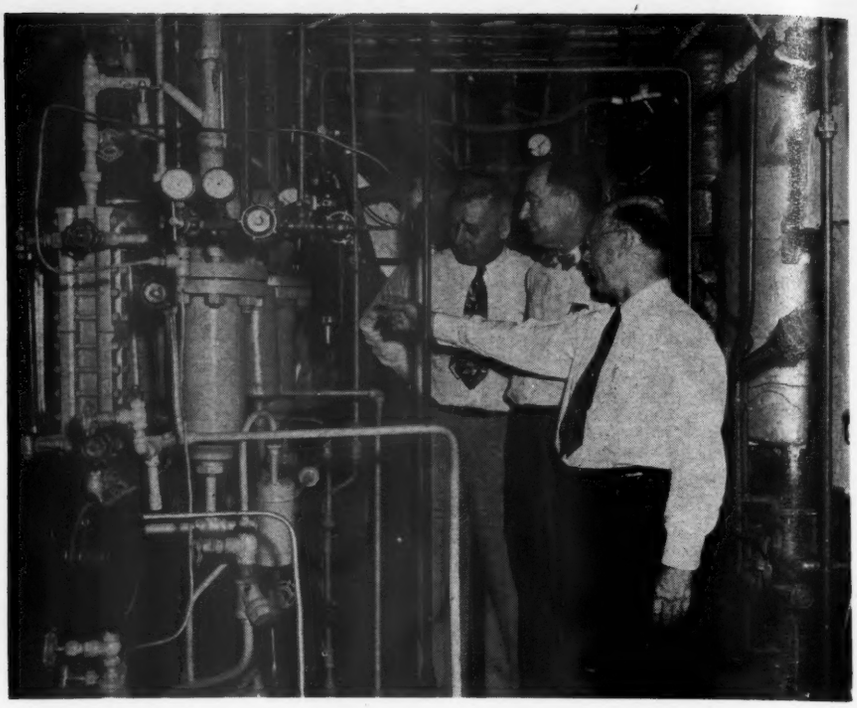
The new Fluid hydroforming process, which is the result of extensive development work by Standard Oil Development Company, Standard Oil (Indiana), and Kellogg, radically improves the economics of the basic process by utilizing the Fluid catalyst principle. In these new units the catalyst, instead of being held in reactors, is finely powdered and moved continuously through the system supported on oil vapors and air. This eliminates the need for shutting down reactor vessels successively to regenerate the catalyst, which was the method employed previously. Considerable improvement is also obtained in the actual catalytic reaction because the finely powdered catalyst provides better catalyst-oil contact than the pelletized variety required for the old style reactors.

Brazil Refinery To Expand

Extension of the oil refinery at Cubatao, Sao Palo, Brazil, is being planned by the government. Similar installations will be made in the states of Rio de Janeiro and Bahia, in order to bring Brazil's total refining capacity up to 160,000 bbl daily, which would cover most of the country's requirements. In addition, Brazil's deposits of bituminous shale are to be developed; a daily output of 10,000 bbl of fuel from the source is foreseen.

Ohio Oil Completes Stripping Plant, Office

Ohio Oil Company has announced completion of a new $200,000 office building and stripping plant costing some $600,000 at Sidney, Nebraska. The new plant will strip excess liquids from natural gas before it is turned into the lines serving Sidney and other cities in western Nebraska. It will have a capacity for processing 13,000,000 cubic feet of gas every 24 hours.



Dr. Blaine B. Wescott, right, explains a fluid type catalyst pilot unit during a tour by Gulf Oil's Production Engineering Conference of the firm's laboratories in Pittsburgh, Pennsylvania recently. Looking on are, left, T. W. Rhoads, division gas-gasoline supervisor, Fort Worth production division, and E. P. Hubbard, for two years chairman of the firm's production research coordinating committee. Dr. Wescott is assistant to the executive vice president of Gulf Research and Development.

Chemists To Meet In New York

Eighteen thousand chemists and chemical engineers from 42 countries will convene in New York September 3 for a two-week World Chemical conclave, which will be the largest chemical gathering ever held.

Advances in many fields of research that may have far-reaching effects on the future of the human race will be reported at the Conclave, which will open with the Diamond Jubilee meeting of the American Chemical Society and will include the Sixteenth Conference of the International Union of Pure and Applied Chemistry and the Twelfth International Congress of Pure and Applied Chemistry.

Contract for Avgas Plant

The contract for design of a sulfuric acid alkylation plant in El Paso, Texas, has been awarded by the Standard Oil Company of Texas to The M. W. Kellogg Company, refinery and chemical engineers of New York City. Cost of the plant will be upwards of a million dollars. The plant will be constructed by Catalytic Construction Company.

It will produce 1400 bbl of gasoline daily with an octane rating of approximately 100/130.

Signal To Enlarge California Refineries

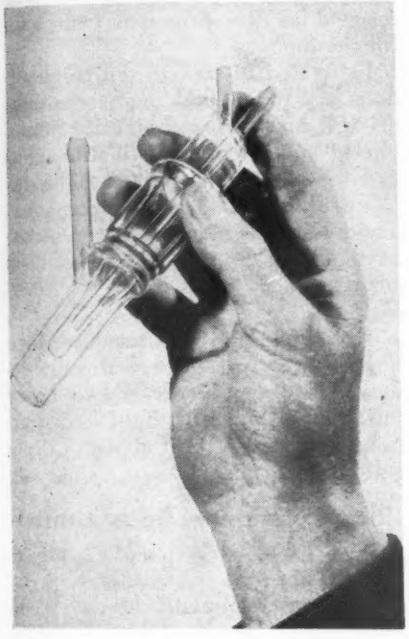
Overall plant production will be increased 10 per cent in Huntingtonbeach, California, by Signal Oil and Gas Company's refinery there. The company also plans to increase production 20 per cent in Long Beach. Among other things, the new additions will allow more butane units to be extracted. To be installed are distillation units, an additional cooling tower, and other equipment. Signal has received approval for fast amortization of 75 per cent of the project.

Mexico Plans 2 Refineries

Two new refineries are being planned by Petroleos Mexicanos for Mexico. The projected construction of these 10,000 bbl per day plants is thought by U. S. oil men in Mexico to be a move to eliminate imported U. S. refined products and to aid the government oil administration's long-standing transport and distribution problems. The new refineries will be at Mazaltan and Salina Cruz on the west coast of Mexico. The Salina Cruz plant will be fed by a 2000 bbl per day excess from the 22,000 bbl per day produced in the Isthmus of Tehuantepec, which is not absorbed by Minatitlan refinery at Vera Cruz.

New Laboratory Micro-Still

A new type of molecular distillation apparatus has been developed in The Texas Company's Beacon, New York, research laboratory, described as "a miniature refining unit no larger than the palm-and-finger span of your hand." This unit has divided by low-pressure distillation a sample of lubricating oil of 0.7 gram weight, or less than one cubic centimeter volume. One-third of this sample was collected as distillate, the remainder as bottoms,



Texaco's tiny still.

each for further analysis. Temperatures as high as 200 C (392 F) are employed in distillation, at a fraction of a millimeter absolute pressure. Some idea of the size of the unit and the pressures employed is given by the statement that "pressure is so low that the mean free path of the molecules is greater than the distance from the charge bed to the condensing surface."

Phillips Petroleum Opens Natural Gasoline Plant

Phillips Petroleum Company will begin operation in June of its new natural gasoline plant in the Chocolate Bayou field of Brazoria County, Texas.

This new plant, under construction during the past eight months, will be known as Bayou plant. It will have a daily capacity for 175,000,000 cu ft of gas, which will yield approximately 150,000 gal per day of natural gasoline products. Gas will be gathered from both distillate and oil wells by a dual gathering system, part of which operates under natural high well pressure and part at lower pressure.

Plants Granted Rapid Tax Write-Off

Deputy Petroleum Administrator for Defense, Bruce K. Brown as presented to the Senate Banking and Currency Committee the following refinery projects that the PAD has recommended for accelerated amortization under the provisions of the 1950 Revenue Act:

Basic refining facilities.

Company and location of facilities	Estimated cost	Per cent recommended	Increase in capacity, barrels per day: Crude oil topping	Catalytic cracking	Catalytic reforming	Catalytic poly'n	Misc.
Puerto Rican Refining, Puerto Rico	$13,385,000	75	20,000	11,000	—	—	—
Bell Oil and Gas, Grandfield, Oklahoma	289,322	75	—	—	1,500	—	—
Midwest Refineries, Inc., Alma, Michigan	933,700	75	6,200	—	1,500	—	—
Standard California, Richmond, California	9,000,000	70	—	7,500	—	—	—
New Mexico Asph. and Ref., Artesia, New Mexico	1,957,000	75	3,000	6,000	—	300	—
Shell Oil Company, Wood River, Illinois	274,000	75	—	—	—	—	Gas line
Roosevelt Oil and Refining, Mount Pleasant, Michigan	894,000	75	—	—	1,380	—	—
Kendall Refining Company, Bradford, Pennsylvania	913,672	75	—	—	1,500	—	—
Standard California, El Segundo, California	57,000	50	—	—	—	—	Fuel shipping
Standard Indiana, Whiting, Indiana	709,300	75	—	—	—	—	Revisions for benzene
Phillips Petroleum Company, Sweeny, Texas	40,767	75	—	—	—	—	Marine loading
Crown Central Petroleum, Houston, Texas	265,000	70	2,350	2,400	—	—	—
Gulf Oil Corporation, Philadelphia, Pennsylvania	40,596,740	65	76,000	47,000	8,930	—	—
Petroleum Specialities, Inc., Flat Rock, Michigan	700,000	70	—	—	900	—	—
Gulf Oil Corporation, Port Arthur, Texas	287,212	50	—	—	—	—	Fuel oil storage
Wilcox Oil Company, Bristow, Oklahoma	1,030,000	65	—	—	1,500	—	—
Southwestern Oil and Refining, Corpus Christi, Texas	5,520,000	70	15,300	5,000	—	—	—
Socony-Vacuum Oil, Buffalo, New York	4,588,000	50	—	4,500	—	672	—
Great Northern Oil, St. Paul, Minnesota	22,550,000	64	30,000	7,620	6,000	680	—
Union Oil Company, Edmonds, Washington	1,000,000	70	4,000	—	—	—	—
Total 4/1—5/11/51	$104,990,713		156,850	91,020	23,210	1,852	
Total 10/3—3/31/51	$318,000,090		371,116	368,700	70,105	5,329	
Grand total	$422,990,803		527,966	459,720	93,315	7,181	

Aviation alkylate and special alkylation feed facilities.
(Recommended for 100 per cent accelerated amortization)

Company and location of facilities	Capital cost	Capacity, barrels per day: Aviation alkylate	Isobutane
Puerto Rican Refining Company, Puerto Rico	$ 4,350,000	500	—
Great Northern Oil Company, St. Paul, Minnesota	3,525,000	2,150	—
Shell Oil Company, Wood River, Illinois	243,000	164	—
Standard Oil Company of California, Richmond, California	24,000	—	iC_4 handling
Socony-Vacuum Oil Company, East St. Louis, Illinois	260,000	775	—
Humble Oil and Refining Company, Baytown, Texas	177,845	800	—
Lion Oil Company, El Dorado, Kansas	810,000	432	—
Total 4/1—5/11/51	$ 9,398,845	4,821	—
Total 10/3—3/31/51	$26,760,485	18,739	957
Grand total	$36,150,330	23,560	957

Benzene and aromatic avgas blending stock facilities.
(Recommended for 100 per cent accelerated amortization)

Company and location of facilities	Capital cost	Capacity, barrels per day: Benzene (1)	Toluene (1)	Aromatic base (2)
Roosevelt Oil and Refining Company, Mount Pleasant, Michigan	$ 605,600	214	224	—
Shell Oil Company, Wood River, Illinois	150,000	—	225	—
Standard Oil Company (Indiana), Whiting, Indiana	460,700	750	—	—
Total 4/1—5/11/51	$ 1,216,300	964	449	—
Total 10/3—3/31/51	$25,886,529	4,152	3,226	10,980
Grand total	$27,102,829	5,116	3,675	10,980

Note 1: Chemical grade
Note 2: Includes toluene and xylene concentrates

(see next page)

Plants Granted Rapid Tax Write-Off—*Continued*

Supporting and petrochemical facilities.

Company and location of facilities	Estimated cost	Per cent recommended	Product	End use
Ethyl corporation, Baton Rouge, Louisiana	$ 175,000	90	Plant security	Tetraethyl lead manufacturing
Standard of Indiana, Wood River, Illinois	2,552,000	80	Isooctyl alcohol	Napalm, plasticizers, etc.
Standard of Indiana, Sugar Creek, Missouri	142,000	80	Heptanes	Isooctyl alcohol
American Cyanamid Company, Michigan City, Indiana	5,077,035	85	1800 T/M catalyst	Catalytic cracking
Total 4/1 — 5/11/51	$ 7,946,435			
Total 10/3/50 — 3/31/51	$75,926,609			
Grand total	$83,873,044			

Basic refining facilities.
(Recommended for 75 per cent accelerated amortization)

Company and location of facilities	Estimated cost	Increase in capacity, barrels per day: Crude oil topping	Catalytic cracking	Thermal cracking	Catalytic reforming	Catalytic poly'n.
Rothschild Oil Company, Santa Fe Springs, California	$ 2,050,000	.....	6,000	.....	.....	...
Union Oil Company, Oleum, California	4,500,000	.....	28,500	.....	.....	...
Union Oil Company, Los Angeles, California	12,000,000	20,000	.....	.....	.....	...
Fletcher Oil Company, Los Angeles, California	176,250	1,356	.....	700	.....	10
Sunland Refining Corporation, Fresno, California	501,653	.....	.....	900	.....	...
Standard of California, El Segundo, California	7,460,000	.....	.....	.....	10,000	...
Ben Hur Refining, Long Beach, California	2,240,000	.....	6,000	3,000	.....	300

Seasonal storage at seaport terminal.
(Recommended for accelerated amortization on 85 per cent of cost.)

Company and location of facilities	Capital cost	Capacity
White Fuel Corporation, Boston, Massachusetts	$800,000	428,600 bbl

Atlas Builds UOP Platforming Unit

Work has been begun on the installation of a 4400 bbl per day UOP platforming unit at the Atlas Processing Company, Shreveport, Louisiana, according to an announcement by J. B. Atkins, president. The platforming unit, which will be built with the utilization of some of the existing refinery equipment, has been designed to process a charge stock of approximately 200-330 F boiling range naphthas obtained from Carthage, Texas, extraction plants.

The Atlas Platforming Unit, designed by Universal Oil Products Company, Chicago, is being constructed by Procon Incorporated, Chicago, and is expected to be completed during the early part of 1952.

Gilmore Plans Texas Refinery

Plans for a 50,000 bbl daily capacity refinery in west Texas to serve a pipe line of similar capacity, which will transport gasoline and other light refined products to the Long Beach Harbor area were announced by Earl Gilmore, California oil man.

Gilmore asked approval of the National Security Resources Board to construct a $20,000,000 refinery which, at first, would have capacity of about 25,000 bbl daily. Provisions would be included in the original design for doubling the capacity.

Richfield To Operate New Cat Reforming Process

The Atlantic Refining Company has announced that it has executed a patent license agreement with the Richfield Oil Corporation covering the operation by Richfield of Atlantic's new catalytic reforming process utilizing a platinum-containing catalyst.

It is contemplated that Richfield's initial application will involve the conversion of about 6000 bbl per day of closely fractionated feed stock to benzene and aviation gasoline aromatics concentrate.

The Sinclair Refining Company has also acquired the right to proceed with installations to use the process, and with regard to that right it is now examining the economics of such installations at capacity levels that may amount to as much as 20,000 bbl per day of gasoline.

Sun Plans Refinery For Sarnia, Ontario

Plans for construction of a refinery by Sun Oil Company to process 10,000 to 15,000 bbl a day of crude oil at Sarnia, Ontario, Canada, were announced by Joseph N. Pew, Jr., chairman of the board of directors.

Commencement of construction depends on the currently tight materials situation, but March 1953 has been scheduled as the completion date for the new plant. Catalytic Construction Company of Philadelphia has been selected as the principal contractor for the job.

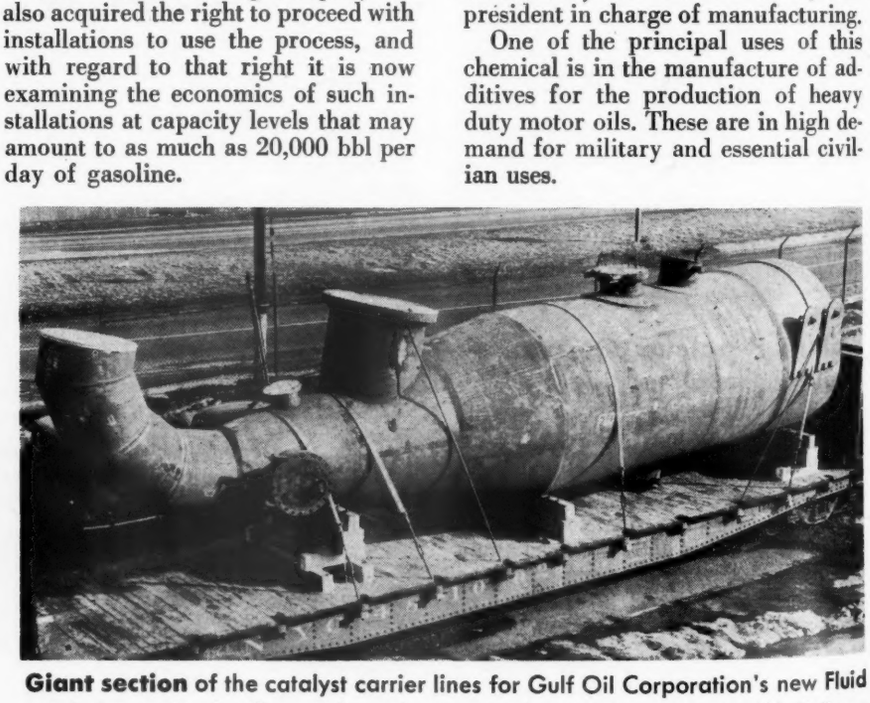
Estimated to cost in the neighborhood of $10,000,000, the Sarnia refinery will consist of combination atmospheric and vacuum distillation units and an 8000 to 10,000 bbl-a-day Houdriflow catalytic cracking unit. The refinery is being designed as one of the most up-to-date and efficient small refinery units in North America.

This refinery will produce high quality motor gasoline, kerosine, domestic heating oil, residual or heavy burning oil and also light hydrocarbons for use by the Polymer Corporation of Sarnia.

Illinois Refinery Adds Unit

Plans for construction of a complete plant to produce 10,000,000 lb of isooctyl alcohol annually at the Wood River, Illinois, refinery of Standard Oil Company (Indiana) were announced by Dr. M. G. Paulus, vice president in charge of manufacturing.

One of the principal uses of this chemical is in the manufacture of additives for the production of heavy duty motor oils. These are in high demand for military and essential civilian uses.



Giant section of the catalyst carrier lines for Gulf Oil Corporation's new Fluid catalytic cracker is shipped from the Jersey City Works of The M. W. Kellogg Company. The section, measuring 43 ft long and about 12 ft in diameter including the nozzles, will be part of Gulf's new 60,000 bbl per day cracker at Port Arthur, Texas.

Refining Papers Given at World Petroleum Congress

Many outstanding papers were given at the Third World Petroleum Congress, which will hold its fifth meeting in the United States in 1959. Dr. E. V. Murphree, New York City, chairman of the Standard Oil Development Company was named chairman of a new committee of the permanent council of the World Petroleum Congress, which held its third convention in The Hague, The Netherlands from May 28 to June 6.

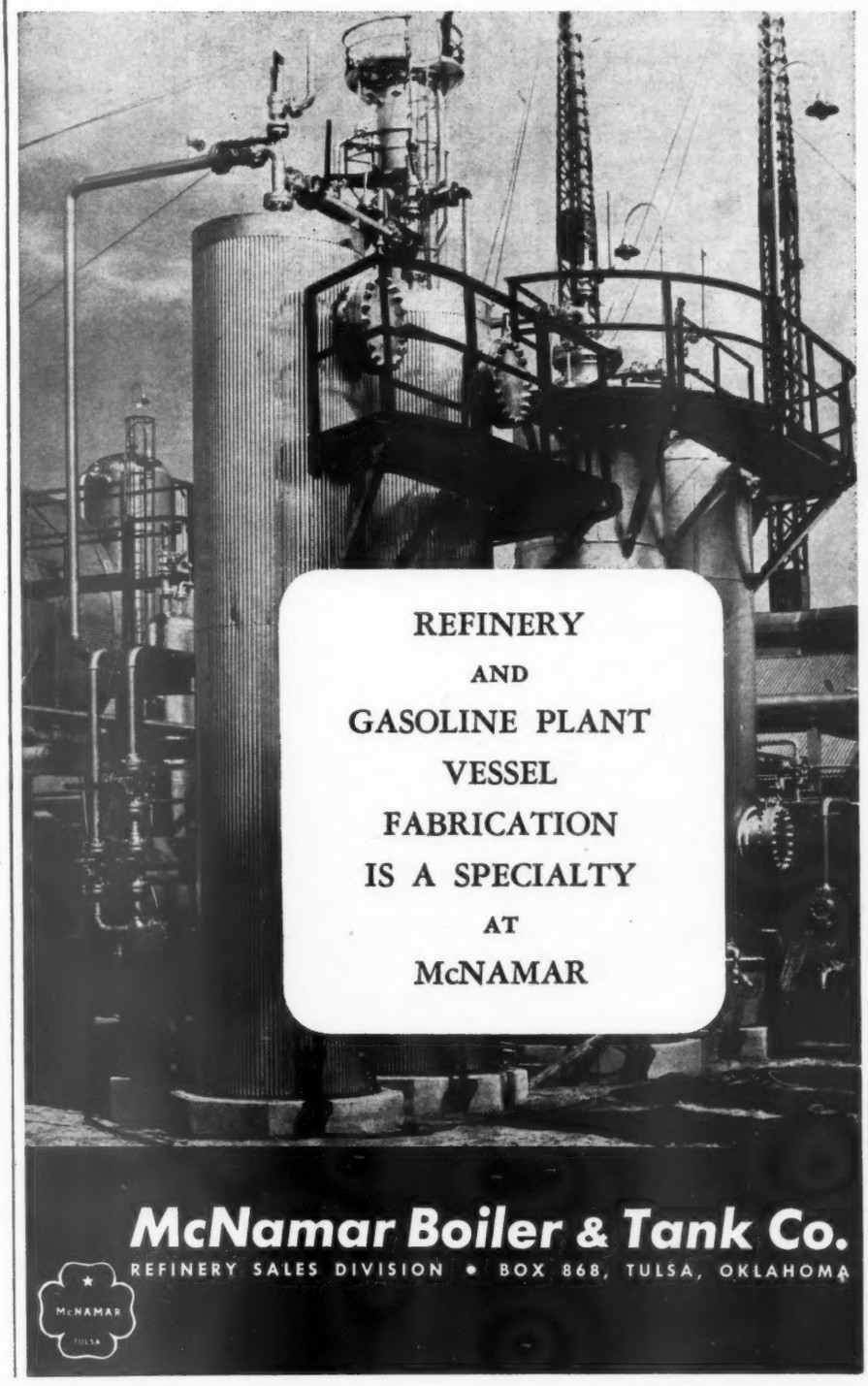
In the physical operations in oil processing section there were such important papers as: Adsorption, A Review of Recent Process Trends, J. A. Berriman, Shell Refining and Marketing Company, Ltd., The Hypersorption Process for Gas Fractionation, C. Berg, Union Oil; Hydrogen Fluoride Extraction of Sulphur Compounds and High Sulphur Petroleum Stocks, A. P. Lien, D. A. McCaulay, and B. L. Evering, Standard Indiana; Furfural Extraction of Middle Distillates, W. P. Gee and H. H. Gross, Texaco Development, and W. E. Skelton, The Texas Company; Report of a New Dewaxing Agent (Precipitator/Solvent Couple), H. Poell, Technical University, Austria.

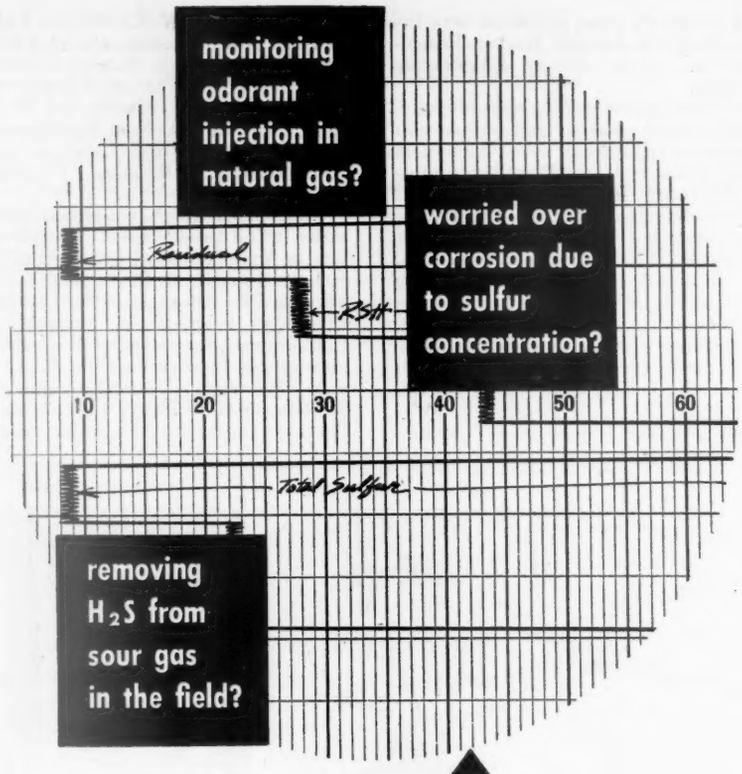
In the Oil Processes involving chemical conversion are found: Mechanism Studies on Fischer-Tropsch Synthesis, Paul H. Emmett and J. T. Kummer, Gulf Research and Development Company; A Study of the Fischer-Tropsch Synthesis Using Fluidized Iron Catalysts, C. C. Hall and J. Rennie, Fuel Research Station, U. S. Bureau of Mines; Fischer-Tropsch Pilot-Plant Studies of Oil-Circulation Processes, H. E. Benson, J. M. Crowell, J. H. Field, and H. H. Storch, Bureau of Mines; High-Pressure Hydrogenation as Applied in the Processing of Crude Oils in Germany, R. Becker, Deutsche Vacuum Oel Aktiengesellschaft; Catalysis in Liquid-Phase Coal Hydrogenation, Sol Weller, Houdry Process and Michail G. Pelipetz, Bureau of Mines; Catalytic Cracking of High Nitrogen Charge Stock, J. W. Schall and J. C. Dart, Houdry Process; Alumina-Silica Cracking Catalyst —Influence of Aluminum Content on Activity, M. W. Tamele, L. B. Ryland, W. G. Schlaffer, Shell Development Company, and L. D. Rampino, Tidewater Associated Oil Company; Operating Variables and Reactions in Suspensoid Cracking, R. K. Stratford and C. H. Caesar, Imperial Oil Ltd.; Contribution of the Houdry Catalytic Cracking Processes to Petroleum Refining, W. F. Faragher, H. D. Noll, and R. E. Bland; Catalytic Cracking of Pure Compounds and Petroleum Fractions, H. H. Voge, G. M. Good, B. S. Greensfelder, Shell Development Company; Catalytic Cracking and Reforming Processes for Increasing the Yield and Octane Number of Gasoline, S. D. Dalton and T. P. Simpson, Socony-Vacuum Oil; Factors Affecting Octane Numbers of Catalytically Cracked Gasolines, E. F. Schwarzenbek, C. E. Slyngstad, P. T. Atteridg, and J. W. Jewell, Jr., The M. W. Kellogg Company; Fluid Hydroforming, E. V. Murphree, Standard Oil Development; Gasoline Sweetening Operations at Palembang Refinery, E. C. Campioni and P. J. Cordia, N. V. Standard-Vacuum Mij.; Desulphurization of Low-Boiling Distillates with Fluid Cracking Catalysts, E. F. Schwarzenbek, C. E. Slyngstad, and J. A. Knaus, The M. W. Kellogg Company.

A paper of special interest under the section on production, properties, and applications of chemicals from petroleum was Petroleum Fuels in Jet and Rocket Propulsion, J. M. Carter, Aerojet Engineering Corporation.

A few of the papers dealing with measurement and control, analysis and testing, and composition of petroleum were: Analytical Mass Spectrometry in the Petroleum Industry, W. S. Young, R. A. Brown, and F. W. Melpolder, Atlantic Refining; The Hydro-Carbon Research Group of the Institute of Petroleum, Its Development and Functions, B. W. Bradford, Hydrocarbon Research Group, Institute of Petroleum; Economics of Instrumentation in Petroleum Refining, A. M. Platt and G. L. Farrar, Texas A.&M. College; Spectrometric Methods of Petroleum Analysis, R. Robert Brittain, Shell Development; L. C. Jones, Jr., and T. P. Wier, Jr., Shell Oil; The Properties of Venezuelan Crude Oils, W. L. Nelson, University of Tulsa, Jose Martorano, and G. Thery Fombona, Ministerio de Fomento, Venezuela; Analytical Hydrogenation of Petroleum Oils, M. R. Lipkin, C. C. Martin, and R. C. Worthing, Sun Oil; A New Technique-Instrumentation of a Fluid Catalytic Cracking Unit, Donald J. Bergman, Universal Oil Products.

Some papers given concerned with utilization of oil products were: Limiting Factors in Manufacture of Lubricating Grease, S. J. M. Auld, H. M. Davies, and E. G. Ellis, Vacuum Oil; Advances in the Utilization of Tetraethyl Lead, J. B. Macauley, Ethyl Corporation; Specificity of Pour Point Depressants in Lubricating Oils, R. A. Ruehrwein, Monsanto Chemical Company; The Mechanism of Boundary Lubrication, F. P. Bowden, University of Cambridge. * * *





Here's the easy, accurate way **TO CONTROL YOUR PROCESS**

The Consolidated Titrilog provides an effective and economical means of continuously and permanently recording the concentration of sulfur compounds in a gas stream.

H_2S, SO_2, mercaptans, thioethers, thiophene, organic disulfides, and other sulfur compounds are recorded quantitatively on the Titrilog strip chart in concentrations as low as 0.1 ppm or 0.005 grains per 100 cu. ft. With this record, control of your particular process is assured. Compounds of specific interest may also be separately determined over a wide range of concentrations.

Whether you are buying or selling field gas, blending or treating, or perhaps odorizing gas in distribution lines, you'll find the Consolidated Titrilog your best means of control. Write today for complete details.

Model 26-102 furnished complete in floor-mounted cabinet 22½" x 18½" x 66". Operates on standard 60 cycle, 115 volt power—requires approximately 6 amperes.

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Write for this informative booklet. Ask for Bulletin CEC-1810-X24

CONSOLIDATED ENGINEERING *Corporation*

Analytical Instruments *for Science and Industry*

300 No. Sierra Madre Villa *Pasadena 8, California*

Ethylene Plant Underway In Wilton, England

In the photo at right are featured the five process steps in the ethylene production plant under construction for Imperial Chemical Industries, Ltd. at Wilton, England by M. W. Kellogg Company. The plant, the first of its kind, will manufacture as its primary product large quantities of very pure ethylene for Imperial's chemical manufacturing operation. It will, however, produce certain quantities of motor gasoline and propylene. The propylene will be further processed by Imperial into isopropyl alcohol and its derivatives.

New Synthetic Rust Preventive Developed

Petrobase 210, a synthetic rust preventive composition, which imparts effective rust preventive properties to petroleum oils, petrolatums and waxes, is a recent development of Pennsylvania Refining Company, Butler, Pennsylvania.

Due to its inherent polar activity Petrobase 210, used in small quantities, causes oils and waxes to displace preferentially water from metal surfaces. This property also prevents redeposition of aqueous vapors or liquids on the metal surface.

Typical physical properties of Petrobase 210 are:

Color	Red-Brown
Specific Gravity, 60/60 F	0.96/0.97
Pounds per gallon @ 60 F	8.0
Viscosity S.S.U. @ 100 F	Approx. 3000
@ 210 F	100/125
Flash Point, C.O.C., F	390
Pour Point, ASTM, F	25
Neutralization Number	1.0-1.5

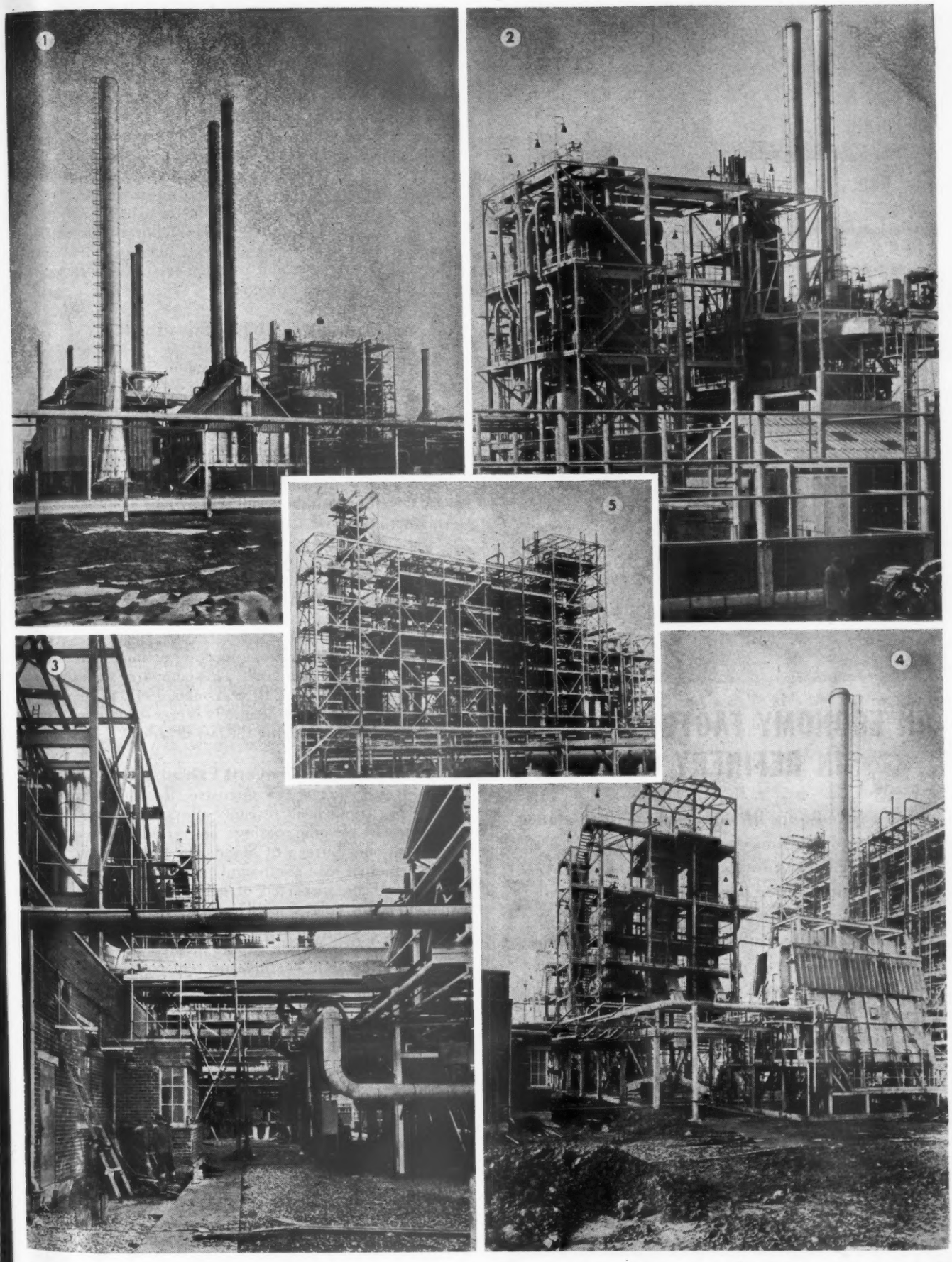
For additional details on Petrobase 210 write direct to Pennsylvania Refining Company, Butler.

Production of Sulfur Maintains High Level

U. S. production of crude sulfur in the first half of 1951 continued at the record level established last year, Langbourne M. Williams, Jr., president of Freeport Sulphur Company, has reported.

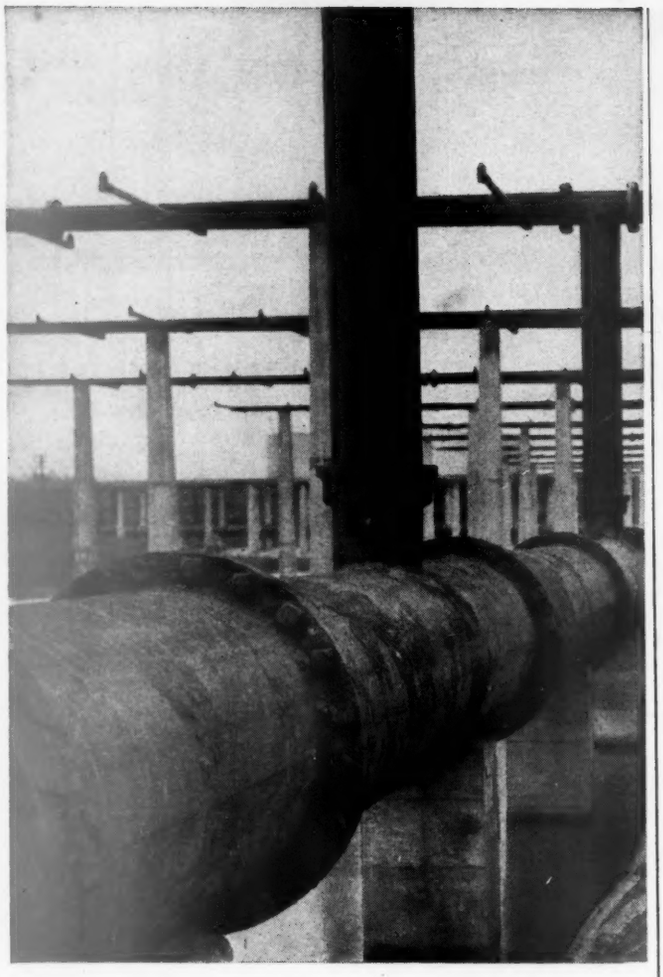
Total output from Gulf Coast brimstone mines and recovery of small amounts of sulfur from natural and refinery gases amounted to about 2,690,000 long tons, he said. For the full year 1950, output was 5,342,000 tons.

"Despite this record production, which is two and a half times prewar levels, sulfur continues to be in short supply," Williams said. "Actually, U. S. output is more than enough to meet the needs of the nation's industry. We are short only because the sulfur industry is being called on to ship substantial tonnages to our Allies."



IMPERIAL CHEMICAL ETHYLENE PRODUCTION PLANT IN WILTON, ENGLAND

In Photo 1, naphtha is being charged to the oil heaters. Before it is fractionated in the primary fractionators, Photo 2, it is charged to the pyrolysis section, Photo 3. Photo 4 shows the polymerizer where unsaturates are polymerized to gasoline. The mixture of gases from the fractionator is piped to the recovery section (Photo 5) where pure ethylene is separated from other constituents. (See Page C-54 for story.)



AN ECONOMY FACTOR
IN REFINERY OPERATION

Proved long life and stubborn resistance to corrosion make cast iron pipe a contributing factor in lowering plant maintenance per barrel of crude. Replacing shorter-lived pipe with cast iron pipe has demonstrated this in many refineries. Cost per term of service decreases. Interference with production, caused by frequent replacements, ceases to be a headache. Cast iron pipe works hand-in-glove with plant management to keep maintenance cost down in many refinery operations. Available with bell-and-spigot, plain end and flanged, or with standardized mechanical joints. Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 1015 Peoples Gas Bldg., Chicago 3, Illinois.

CAST IRON PIPE
FOR LONG LIFE AND ECONOMY

New Testing Device Developed

A method for determining the effectiveness of lubricants at pressures previously impossible to measure with scientific accuracy in ultra-thin films has been developed for research purposes in the laboratories of the Socony-Vacuum Oil Company, Inc.

A testing instrument developed in the research and development department, Socony-Vacuum Laboratories, Paulsboro, New Jersey, can exert measurable pressures up to 250,000 psi between two metal bearing surfaces.

Company executives said the instrument, in addition to its value for lubricant studies, has important potentialities for determining the point at which films of solids such as soap will break down and permit contact between two surfaces under extreme pressure.

ASTM Approves 57 New Standards

Featured by 23 technical sessions at which were presented 110 technical papers covering various aspects of engineering materials, the 1951 annual meeting of the American Society for Testing Materials, held recently at Atlantic City, also included 615 meetings of the technical committees. The registered attendance—2277—is a new high compared with the 1950 figure of 2131.

Sixty-two of the society's technical committees reported at the meeting, with the result that 57 new specifications and tests were approved and revisions in over 200 existing tentatives and standards were acted on. About 75 specifications and tests that have been published previously as tentative were approved for reference to Society letter ballot for adoption as standard. All of these new and revised specifications will be published later in the year in the 1951 Supplement to the Book of ASTM Standards.

Including the 1951 annual meeting actions there are now about 1775 ASTM standards. This compares with the figure 20 years ago of 625 and 10 years ago, 1941, of about 1045. These figures indicate a definitely increased tempo in standardization activities during the last decade.

Ceramic Coatings Prevent Exhaust-Gas Corrosion

An investigation of the corrosive effects of lead bromide vapors on various heat- resistant alloys, both with and without protective ceramic coatings, has recently been completed at the National Bureau of Standards. Lead bromide, which is the principal lead compound present in aircraft exhaust gases, has been suspected of contributing significantly to exhaust-system corrosion. The NBS investigation demonstrates that the uncoated alloys corrode fairly rapidly when exposed to lead bromide vapors at high temperatures, but that certain ceramic coatings prevent corrosion effectively under the same conditions. Sponsored by the National Advisory Committee for Aeronautics, the studies were conducted by Dwight G. Moore and Mary A. Mason of the NBS enameled metals laboratory.—Technical Report 1544

Weed and Grass Killer Available

Lion Oil Company announces perfection of a weed and grass killer designed to destroy practically every type of herbaceous plant on which it is sprayed. Known as Lion Herbicidal Oil No. 6, this new product is relatively non-toxic and poses no danger to livestock, persons, or to gardens, flowers and ornamental shrubbery adjacent the areas treated.

"Lion's HO6 is the result of careful refining of one of our highgrade, highly aromatic crudes," T. M. Martin, Lion president stated. "It is classed as a general contact agent and is proving far more economical and efficient for application along railroad rights-of-way than other types of chemical sprays used for that purpose. The oil is safe, non-inflammable and not injurious to livestock.

Warren L. Smith, M. W. Kellogg president, second from left displays one of more than 100 gold watches given in recognition of 25 years or more of service with the company at Kellogg's 50th anniversary banquet. With him is Champ Carry, president of Pullman, Inc., second from right. At far left is Roy Walls, Kellogg's personnel director and at extreme right is Herbert R. Schuster, chairman of the committee that planned the banquet.

New Motor Oils Classification Proposed

A few years ago the API and SAE set up the following service classifications for motor oil: (1) Regular type; (2) premium type; (3) heavy duty type (primarily for trucks and buses). Due to changes in automotive engine designs, it has been necessary to supply large amounts of heavy duty type for automobiles, thus it is not now correctly designated. Further, an additional classification is needed. At the recent meeting in Cincinnati of the API Lubrication Committee the following new service classifications were proposed.

Service "MO"—service typical of gasoline and other spark ignition engines operating under favorable service conditions and not having any special lubrication requirements due to fuel or to engine design characteristics. Stop-and-go driving and prolonged idling, especially in cold weather, are not favorable service conditions.

Service "MS"—service typical of gasoline and other spark ignition engines operating under severe service conditions and/or where there are special lubrication requirements due to fuel or to engine design characteristics.

Service "DO"—service typical of diesel engines in any service where there are no exceptionally severe requirements for deposit control due to fuel or to engine design.

Service "DS"—service typical of diesel engines operating under extremely severe service conditions or having special design characteristics or using fuel tending to produce abnormal wear and/or deposits.

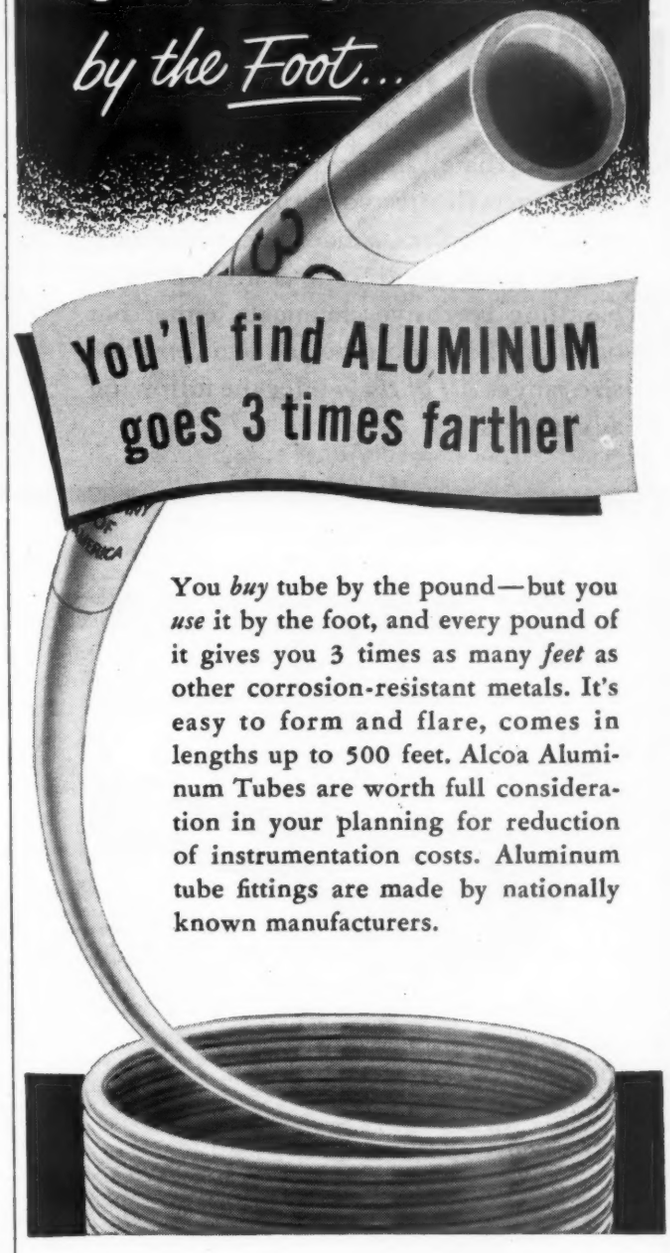
Texaco Service Office Opened

A new technical service field office, which will maintain a close working liaison with the automotive industry, has been opened in Detroit, Michigan, by the technical and research division of The Texas Company.

K. L. Hollister, technical representative, is in charge of the new Texaco office. He will cooperate closely with manufacturers of passenger cars, busses, trucks, and allied equipment on problems relating to fuels and lubrication.

Other offices are in Houston, Los Angeles, Chicago.

Figure tubing installations *by the Foot...*



You'll find ALUMINUM goes 3 times farther

You *buy* tube by the pound—but you *use* it by the foot, and every pound of it gives you 3 times as many *feet* as other corrosion-resistant metals. It's easy to form and flare, comes in lengths up to 500 feet. Alcoa Aluminum Tubes are worth full consideration in your planning for reduction of instrumentation costs. Aluminum tube fittings are made by nationally known manufacturers.

DUE TO REARMAMENT aluminum is not available for unrestricted industrial use. However, when tubing is used, extensive engineering and planning are often required. This advertisement is intended as an aid to your planning.

For facts on aluminum tubes, write for Alcoa's booklet, "Instrument Lines of Alcoa Aluminum"—illustrated, crammed with facts! Address, ALUMINUM COMPANY OF AMERICA, 839H Gulf Building, Pittsburgh 19, Penna.

ALCOA ALUMINUM

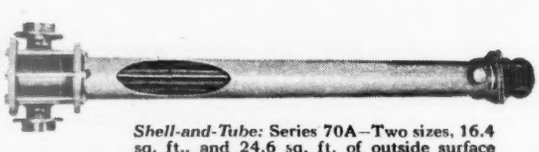
ALCOA *Coiled Tubes* ALUMINUM

To obtain more information on products advertised see page E-35

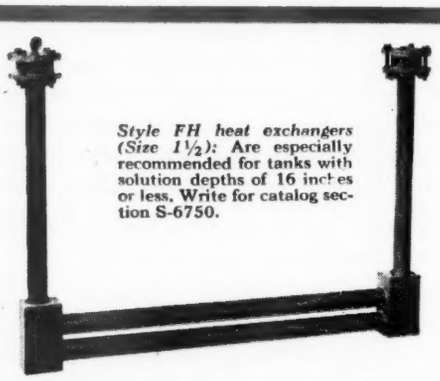
"KARBATE" BRAND IMPERVIOUS GRAPHITE HEAT EXCHANGERS *FOR ALL PURPOSES!*

The "Karbate" impervious graphite heat exchangers illustrated are used extensively as boilers, coolers, condensers, vaporizers, evaporators, heaters and absorbers in handling corrosive chemicals, either hot or cold. They *all* can be had in a complete size range. *All of them* offer the following advantages:

- **Highest heat conductivity rate of the practical corrosion-resistant materials.**
- **Highly resistant to corrosion by acids or alkalis, hot or cold.**
- **Freedom from corrosion scale, as compared to metals.**
- **Immune to thermal shock.**
- **No contamination of product.**
- **Strong and easy to install and maintain.**



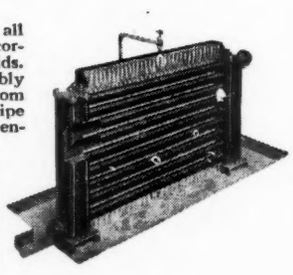
Shell-and-Tube: Series 70A—Two sizes, 16.4 sq. ft., and 24.6 sq. ft. of outside surface area respectively. Tubes easily replaced in the field. Interchangeable single and double-pass construction.



Style FH heat exchangers (Size 1½): Are especially recommended for tanks with solution depths of 16 inches or less. Write for catalog section S-6750.

Series 240A—70.6 feet of outside heat transfer surface. Easy tube replacement. Easily converted on job to single, double, or four-pass tube side flow by simple change of fixed covers. Steel, shell, oversize shell connections, impingement plates and drain and vent plugs integral with shell end castings. Stainless-steel baffles assembled with steel tie rods to form protective cage for tube bundle. Removable "Karbate" tube bundle. Write for catalog sections for S-6690, S-6715 for details of applications, maintenance, sizes and characteristics of these exchangers.

Cascade coolers: For all cooling jobs involving corrosive gases and liquids. Complete cooler assembly may be made quickly from 4 standard items in 5 pipe sizes. Capacity easily enlarged or reduced by adding or subtracting standard sections. Compact construction to save plant room. No special supporting structure needed. Write for catalog section S-6780.



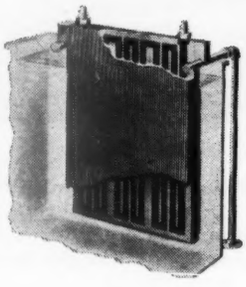
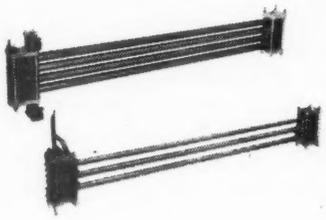


Plate heaters: Used to heat or cool corrosive liquids in tanks and vessels. Compact, completely assembled. easy to put in. Used in pickling, etching, plating and cleaning tanks. Complete size range. Models for horizontal and vertical mounting. Write for catalog section S-6620.



Concentric Tube exchangers: Available in two types. Series 10A is small, low-priced, gives true counterflow. Exceptionally good for small flow rates at narrow temperature differences . . . Series 20A manufactured with "Karbate" inner and outer piping, and is used to transfer heat between two corrosive fluids. Both have sectional construction, can be added to or subtracted from at will. Sturdy, can be moved from place to place after assembly, adapted to any method of mounting on floor, wall, or ceiling. Write for catalog section S-6670.

The term "Karbate" is a registered trade-mark of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

In Canada: National Carbon Limited
Montreal, Toronto, Winnipeg

A full line of "Karbate" impervious graphite pipe and fittings

for conveying corrosive chemicals includes: "Karbate" pumps of advanced design embodying impervious graphite case, impeller, and a rotary seal which eliminates the stuffing box. Pump prices reduced up to 33%. Write for catalog section S-7000 for pipe information, S-7200 for pump information.

—PERSONALS—

V. G. Bartram, of Montreal, president of Shawinigan Chemicals Limited, has been elected president of B. A.-Shawinigan Limited, the newly organized petrochemical company owned jointly by the British American Oil Company Limited and Shawinigan Chemicals Limited.

Vice president of the new company is **M. S. Beringer** of Toronto, British American's vice president in charge of manufacturing. Other directors of the new company are **Dr. R. S. Jane** and **P. W. Wright,** Montreal, vice president and secretary treasurer respectively of Shawinigan Chemicals, and **H. T. O'Neill** and **R. E. Irwin,** of Toronto, vice president (finance) and chief chemist respectively of British American.

The head office of B. A. Shawinigan Limited is in the Shawinigan building, 600 Dorchester Street West, Montreal. Secretary treasurer is **G. S. Herring.**

Henry A. Heiss has been appointed manager of Pan-Am Southern Corporation's Destrehan, Louisiana, refinery. Heiss joined Pan-Am from Standard Oil Company (Indiana) where he was general foreman of the light oils division, supervising the operation of catalytic cracking units.

Earlier Heiss served as general foreman of Standard's heavy oils operations. He is a chemical engineering graduate of the University of Iowa, where he also did post graduate work.

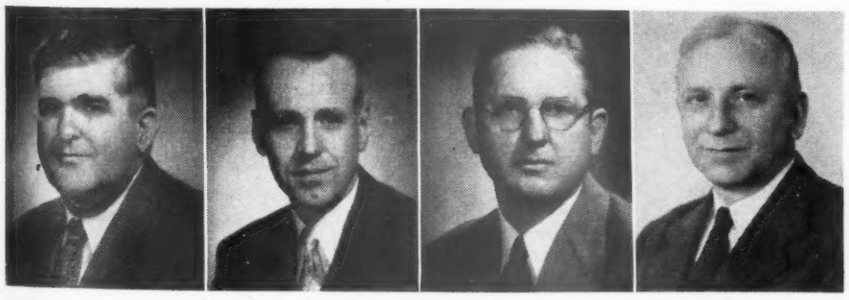
The position of Destrehan manager is a new one, created to meet the needs of the multi-million dollar expansion plans of Pan-Am at Destrehan. A cat cracker, fluid hydroformer, vapor recovery unit, and alkylation unit will be under construction shortly at the refinery.

J. D. Tufts, superintendent at the refinery for many years, will continue in that capacity. R. L. Argus and V. G. Relimpio will continue as assistant superintendents.

J. G. Woods, recently appointed manager of Mathieson Hydrocarbon Chemical Corporation's plant at Doe Run near Brandenburg, Kentucky, and his staff have moved from Boston to Doe Run to follow the final stages of construction and prepare the plant for initial operation. Before going to Doe Run, Woods was in charge of the Mathieson Hydrocarbon design group.

A. L. Willie, who has been resident manager of Doe Run will return to Mathieson Chemical Corporation at Baltimore, Maryland.

Woods, prior to joining Mathieson Hydrocarbon in 1950, was superintendent of Dow Chemical Company's ethylene plant at Freeport, Texas. He is a graduate of the University of Texas.



Dr. Joe D. Clary | Walter K. O'Loughlin | Kenneth E. Prince | Dr. Albert H. Cooper

Dr. Joe D. Clary has been named superintendent of the Davison Chemical Corporation's specialty catalyst plant operated at Curtis Bay (Baltimore) by Davison. Clary is a graduate of Emory University and Ohio State University. He was formerly with Chemical Products Corporation.

Dr. Albert H. Cooper has been appointed head of the research engineering department of the research and development division. Cooper graduated from the University of Tennessee, and Michigan State College.

Walter K. O'Loughlin has been appointed manager of the development department of the research and development division. O'Loughlin is a graduate of the Catholic University of America. He was formerly with the Air Forces intelligence department.

Kenneth E. Prince has joined the research and development division of Davison as head of the patent department. Prince was graduated from the University of South Carolina. In 1945 he received his bachelor of laws degree from the Chattanooga College of Law. He was formerly with Phillips Petroleum Company.

J. W. Wilson has been named superintendent of operations and **M. F. Wirges** chief process engineer for the gasoline-chemical division, Cities Service Oil Company, (Delaware). In connection with these added responsibilities, Perry announced that Wilson and Wirges will work under the direct supervision of Ralph W. Johnston and Harry P. Hohenadel, general superintendents of the gasoline and chemical divisions, respectively.

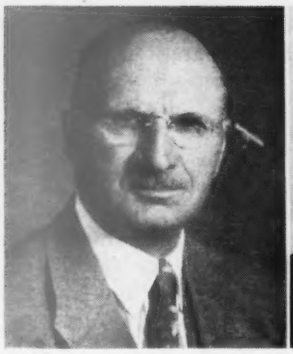
Jonathan R. Roehrig is now associated with National Research Corporation as a project manager in the company's physics research department. Roehrig received a B.S. and M.S. in communications from Massachusetts Institute of Technology in 1939. In 1948 he joined Submarine Signal Company and its successor Raytheon Manufacturing Company, where he continued in the sonar section until joining National Research Corporation.

Melvin H. Gertz | Robert L. Purvin

Melvin H. Gertz has joined Robert L. Purvin Consulting Chemical Engineers as a partner in the organization, which will henceforth be named Purvin and Gertz, Consulting Engineers. Personnel of the engineering organization will be unchanged and offices will remain at 501 Reserve Loan Life Building, Dallas, Texas. Gertz has been associated with the firm for the past four years as process consultant and project engineer. Prior to that time he was employed on the engineering staff of Humble Oil and Refining Company.

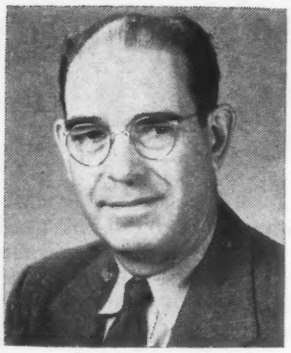
B. F. Wingrove has been appointed operating department superintendent of the Socony-Vacuum Oil Company's Paulsboro, New Jersey refinery, succeeding **R. M. Chesney,** new manager of the Deep Rock Oil Company refinery at Cushing, Oklahoma. Wingrove served at Magnolia Petroleum Company's Beaumont, Texas refinery for 11 years before being transferred to Paulsboro in 1949.

S. W. Thompson, supervisor of specialities in the package division, has been named assistant superintendent of the lubricating oil division of the operating department.



George C. McLaren

Warren H. Kraft



A. M. Hovlid

George C. McLaren, general superintendent of southern district natural gasoline department, Standard Oil of California, has been named president of the California Natural Gasoline Association. **Warren H. Kraft,** director of Honolulu Oil Corporation, has been named vice president of the organization, with **E. R. Millett, Jr.,** reappointed as secretary-treasurer.

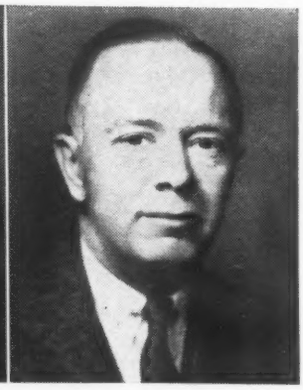
In addition to the past presidents who are ex-officio members, the following were appointed to serve on the executive committee: **F. E. Bradley,** CCMO; **C. L. Case,** Continental Oil Company; **R. C. Enderly,** Wilmington Gasoline Company; **Fred Hartley,** Union Oil of California; **Ray Hull,** California Research Corporation; **C. L. Hutchings,** Tide Water Associated Oil Company; **E. W. Walker,** Western Gulf Oil Company; **P. E. Foote,** Petrolane, Ltd; **M. L. Fort,** Pacific Lighting Gas Supply Company; **Grove Lawrence,** Southern California Gas Company, and **Winton J. Heinz,** Ingersoll-Rand Company.

A. M. Hovlid, Ponca City, Oklahoma, personnel supervisor in Continental Oil Company's manufacturing department, has been promoted to coordinator of personnel research for the entire company. In his new position Hovlid will continue to make his headquarters in Ponca City.

Hovlid joined Continental in 1923, as a chemist, at Florence, Colorado. He was awarded his chemical engineering degree at the University of Colorado and also was an instructor there for a short period.

Walter H. Aldridge
Chairman of Board

Fred M. Nelson
President



Thomas S. Lamont
Chairman, Executive Committee

Walter H. Aldridge has been elected chairman of the board of Texas Gulf Sulphur Company, and **Fred M. Nelson** has been named president. Aldridge has been president of Texas Gulf Sulphur since it began operations 32 years ago. Prior to assuming the presidency of Texas Gulf Sulphur in 1919 he founded The Consolidated Mining and Smelting Company of Canada, Ltd., and was president of Magma Copper Company.

Nelson has been in charge of many of Texas Gulf Sulphur's field operations since he joined the company in 1927. From 1945 to 1950 he was an executive assistant. He is a graduate of the Colorado School of Mines.

Thomas S. Lamont has been elected chairman of a newly-formed executive committee. Other members are **Erle V. Daveler** and **Lowell C. Wadmond.** Lamont, executive committee chairman, is vice president of J. P. Morgan and Company Inc. Daveler, executive committee chairman, is vice president and a director of American Zinc, Lead and Smelting Company, and Wadmond is a member of the law firm of White and Case.

Dr. W. J. Coppoc has been promoted to associate director of research in The Texas Company's technical and research division with headquarters in the New York Office. **Dr. Charles E. Moser** has been named to succeed Dr. Coppoc as assistant director of research at the company's Beacon Research Laboratories, Beacon, New York.

Dr. Coppoc joined Texaco temporarily as a chemist at the Port Arthur, Texas, refinery, in 1938. He received his Ph.D. from Rice Institute in 1939, then returned to the company.

Dr. Moser received his Ph.D. from Northwestern in 1939 and entered the service of the company.

Gus Kaufman has been appointed assistant manager of the technical and research division of The Texas Company.

Kaufman is a lubrication specialist, whose work during World War II won him a Naval Ordnance Development award. He is the author of many patents and publications on lubricating greases, cutting oils, gear lubricants, and allied subjects.

Graduated from Rice Institute, Houston, Texas, in 1924, he was employed by The Texas Company shortly thereafter. From 1931 to 1941 he was in charge of grease research at Texaco's Beacon, N. Y. Laboratories. During the past 10 years he has served as staff technologist and assistant to the manager of the Technical and Research Division, New York.

C. R. Nelson, Jr., M. L. Courter, and **M. E. Stromsmoe** of the Shell Development Company, Emeryville, California, are in Grangemouth, Scotland where they will assist in the start-up of a new multi-million dollar synthetic ethyl alcohol plant.

Max A. Minnig, vice president in charge of the Witco Chemical Company's carbon black division, was elected to the board of directors at a meeting of the board held in Chicago recently. **William Wishnick** was appointed assistant treasurer.

Charles N. Kimberlin, Jr. has been appointed senior research associate by Alex Voorhies, Jr., director of the Esso Laboratories, Esso Standard Oil Company, Louisiana division.

Kimberlin has been associated with the Esso Laboratories since 1933. His achievements, the company announced have been in the fields of chemical and petroleum research leading to the development of new catalysts and to improved processes.

The new senior research associate received the B.S. degree in chemistry from Louisiana College in 1931 and the M.S. from Louisiana State.

The Common Carrier Question

THE CASE of El Paso Natural Gas Company vs the United States Department of the Interior, which involves the crossing of public lands by pipe lines, and in turn the question of whether this makes a pipe line a common carrier, is of vital importance to the industry. An unfavorable decision would have a far-reaching impact and conceivably could affect the entire gas pipe line structure, those lines many years in operation as well as new systems. This could be so because there are few pipe lines that do not cross at least some small parcel of public domain somewhere along the route.

What is this whole thing about? Chronologically, El Paso Natural last summer applied to Interior Department for right-of-way across 16 miles of public lands in Arizona on its line from Texas to Topock, Arizona. The right-of-way was granted, but later Interior changed its mind. On what basis could it justify this? Briefly, it is an interpretation of law.

Section 28 of the Mineral Leasing Act of 1920 says that the Department of Interior shall grant pipe line companies rights-of-way across public lands "... upon the express condition that such pipe lines shall be constructed, operated, and maintained as common carriers."

This is the basis for Interior's case.

An amendment to the law, however, written in 1935, places a comma after the words "common carriers" and continues "and shall accept ... without discrimination oil or natural gas produced from government lands in the vicinity of the pipe line. ..."

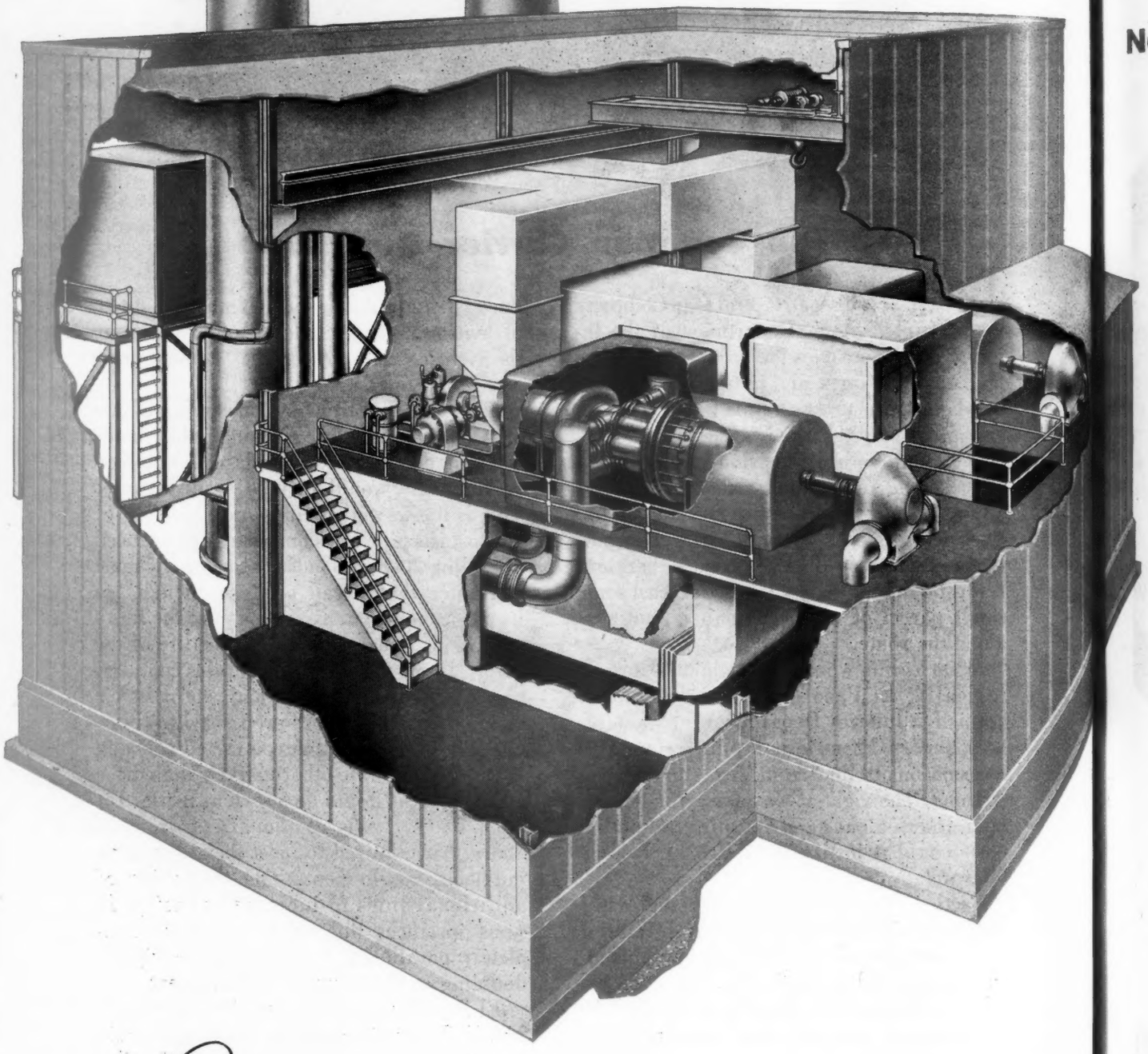
On this amendment El Paso Natural bases its case. It is argued that, inasmuch as the amendment specifically mentions gas produced from public lands, it was the intent of legislators to exclude all other gas from the right of transport on the "common carrier" pipe line.

The entire controversy, of course, hinges on whether a pipe line crossing public lands is a common carrier. If declared a common carrier, why would that be so disastrous? This is the way it would work:

Most gas pipe line companies are financed by selling 20-year bonds. The company must guarantee that it can produce enough gas itself, or buy enough gas, to assure the line's operation at near capacity for the life of the bonds. It must also show firm sales contracts that will pay interest on and amortize the bonds. If gas pipe lines are forced to transport gas other than that contracted for, and compelled to sell to other markets than those guaranteed, it would be a serious matter for them. To carry this additional gas, over and above that required to meet their own commitments, would necessitate the laying of additional lines to increase capacity. In some instances this might result in completely paralleling a system, and a virtual doubling of the company's investment.

El Paso Natural has won the first round. The U. S. District Court in Washington said the gas company could cross the 16 miles of public domain in Arizona. Its decision was based on the fact that Interior had reneged on its original approval. This does not mean that the case is settled, however. Yet to be determined is whether Interior has the authority to require such terms as is its contention, and therein is the danger. If Interior is victorious the way is open for it to demand the same stipulation of many other lines, both new and old. F. H. L.

Cuts gas



You can put your confidence in—

GENERAL ELECTRIC

661-29

pumping costs!

Now—substantial double savings can be yours with the G-E combustion gas turbine for gas pipeline pumping—a complete, practical, and reliable prime mover!

No doubt about it! The General Electric gas turbine—specially designed for gas pipeline pumping—offers gas pipeline operators really big savings in total annual costs. Here's how:

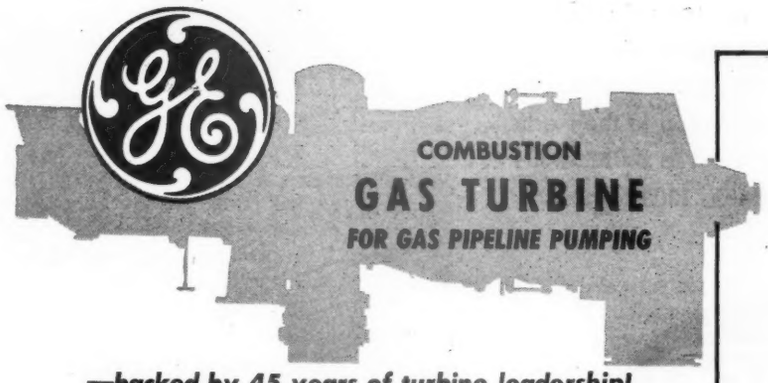
Cuts Construction Costs

In relation to available horsepower, the building housing the G-E gas turbine is small, simple, and inexpensively constructed. In the typical station layout at the left—containing two 5000-hp gas turbines each driving a centrifugal compressor—the building area is only 48 by 64 feet, with a roof elevation of 40 feet. Moreover, building and equipment foundations are less expensive because the turbines, and the centrifugal compressors they drive, are relatively small and light in weight.

Cuts Operating and Maintenance Costs

Essentially automatic in operation, the G-E gas turbine makes it possible to release manpower for other duties. The unit readily lends itself to remote operation of an unattended station. Maintenance is largely a matter of periodic inspection, since there are comparatively few moving parts subject to wear. Little or no make-up water is needed—an additional saving.

Other advantages? It delivers up to 25 per cent extra horsepower at no extra cost in winter—provides adjustable speed for operating flexibility—is inherently suited for use with readily available, high-efficiency centrifugal compressors.



—backed by 45 years of turbine leadership!

GET MORE INFORMATION!

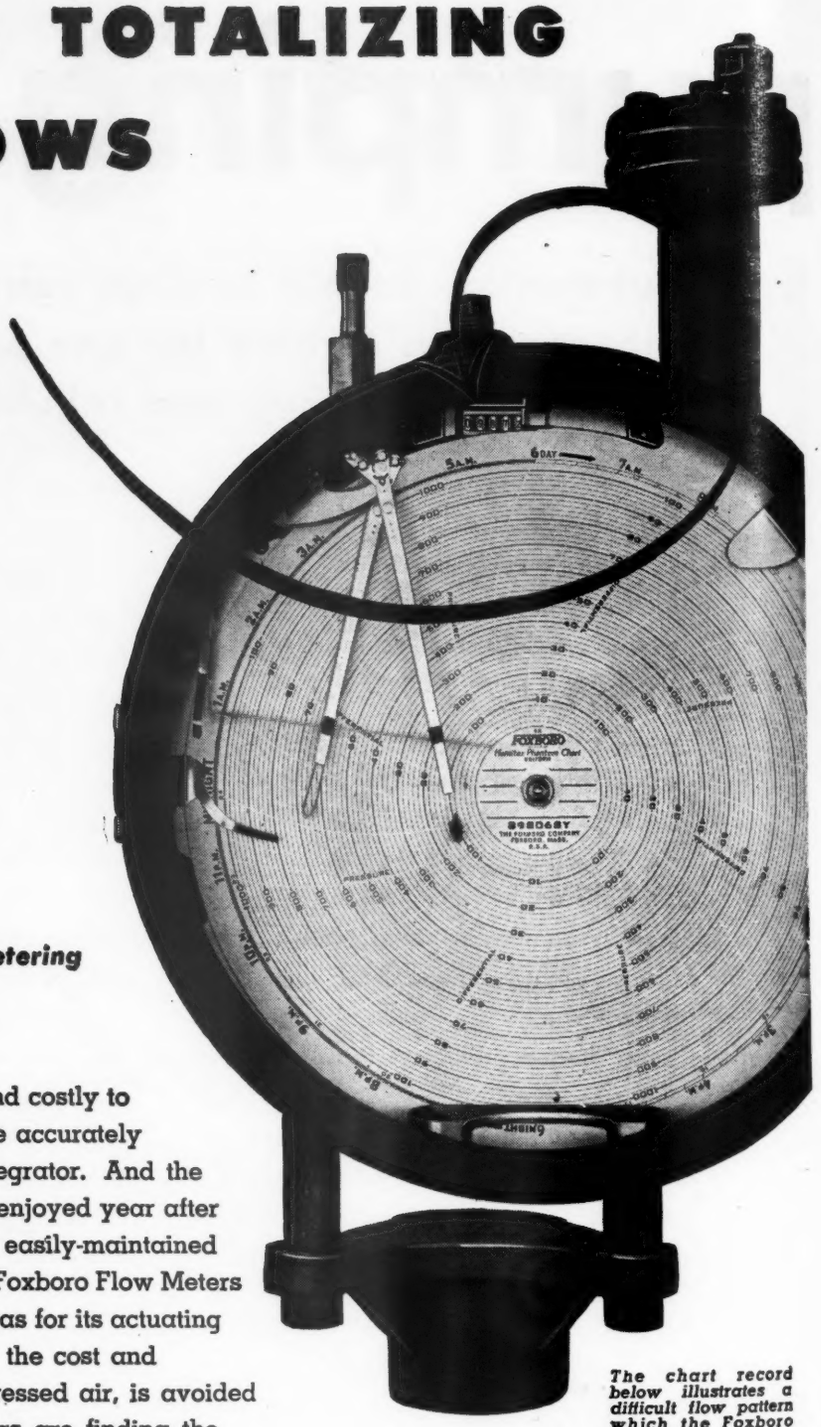
Call your nearest G-E sales office, or send today to Section 661-29 for new 16-page booklet GEA-5530 that describes in detail how the G-E gas turbine can cut *your* annual pumping costs. *General Electric Company, Schenectady 5, N. Y.*

AUTOMATIC TOTALIZING of GAS FLOWS

pneumatic integrator accurately follows even rapidly varying flows

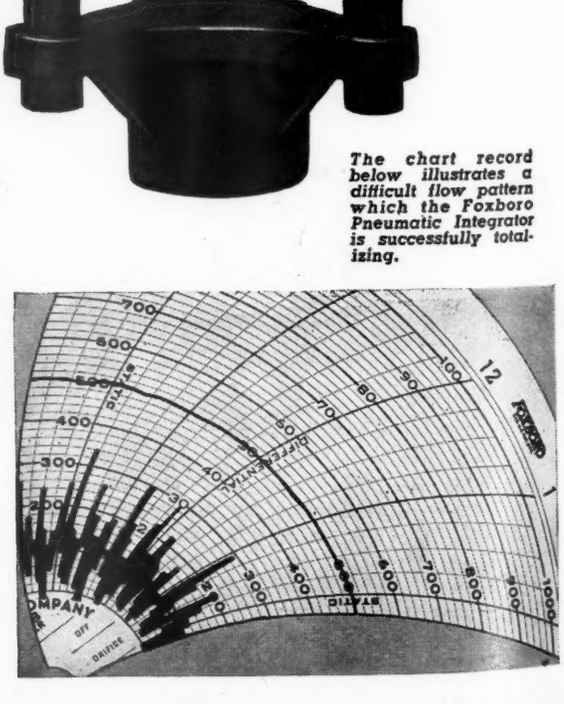
the counter reads directly in cubic feet—or other desired units.

★ *saves time and cost of planimetering*
★ *eliminates electrical hazard*



Even rapidly varying flows, so difficult and costly to integrate manually with a planimeter, are accurately totalized with the Foxboro Pneumatic Integrator. And the savings over "manual" totalizing will be enjoyed year after year, indefinitely. ↑ ↑ ↑ This simple and easily-maintained device, which is available on all types of Foxboro Flow Meters used in the oil fields, utilizes the flowing gas for its actuating power. Thus the hazard of electricity, or the cost and difficulty of providing a supply of compressed air, is avoided altogether. ↑ ↑ ↑ Many oil field operators are finding the Foxboro Pneumatic Integrator an ideal solution to their gas flow totalizing problems. It is fully described in Bulletin 394 . . . write for your copy. **The Foxboro Company, 1308 Neponset Avenue, Foxboro, Mass., U. S. A.**

The chart record below illustrates a difficult flow pattern which the Foxboro Pneumatic Integrator is successfully totalizing.



FOXBORO
REG. U. S. PAT. OFF.
Instrumentation

Welding double joints down the right-of-way with submerged arc welding unit.

Making a weld, showing details of head, drive chain, and attachment of flexible arms to main frame.

P 622.32

Submerged Arc Welding of Pipe on the Line

Multiple-jointing method used on Trunkline spread increases construction speed

FRANK H. LOVE*

PORTABLE submerged arc welding equipment developed by O. R. Smith of Fort Worth, Texas, has been used for the first time to multiple-joint pipe on the right-of-way. The work was done on the Mahoney Contracting Company spread between Flora and Joppa, Illinois, on the Trunkline Gas Company system. Two and three joints of the 40-ft, 26-in. pipe were welded together, to be tied into the line by hand welders, and, inasmuch as pipe of this diameter can be welded in two passes in a total of 4½ min. by the submerged arc method, the speed of welding was greatly accelerated.

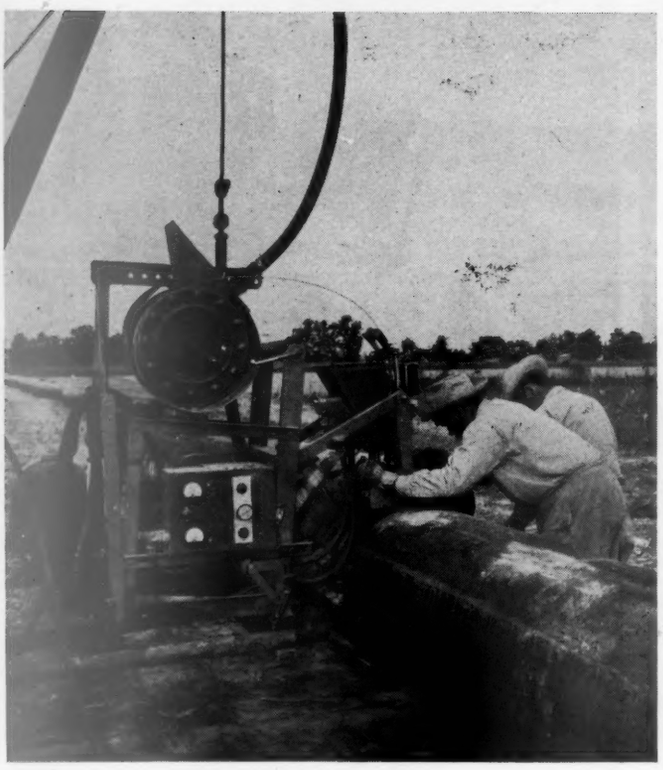
The equipment, several views of which are shown in accompanying photographs, is a light unit that can be mounted on any sideboom tractor and can make welds in any place the tractor can go. The quality and uniformity of the welds are the same whether the equipment is operating on a hill, in mud, or on level terrain.

The machine is designed to weld pipe of 16 in. through 30 in. diameter, and, as mentioned, double and triple jointing was employed on the Trunkline job; however, the number of joints that can be welded into one section is limited only by the total length of pipe that can be handled most practically with the equipment available.

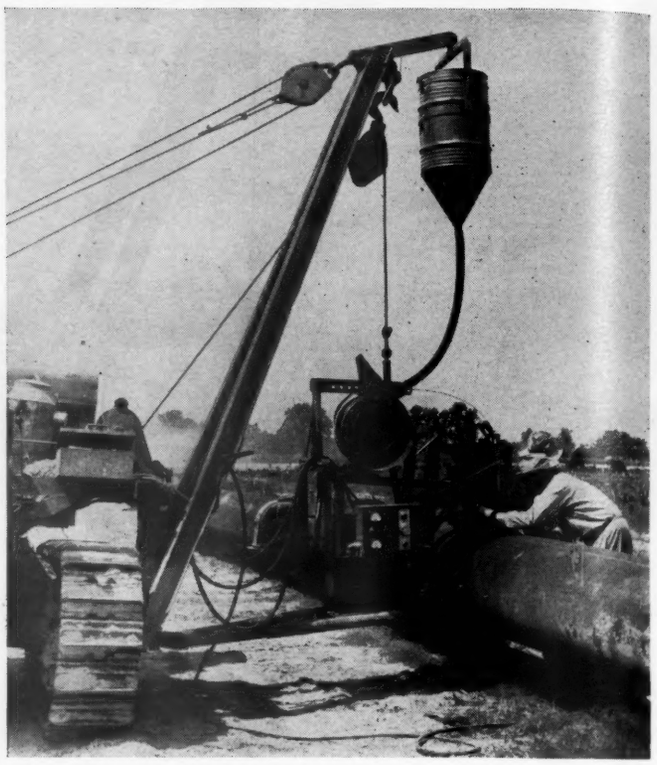
The machine consists of a welding head carried on a four-wheel carriage, which rides on top of the pipe. The carriage has self-adjusting features so that welding can be done accurately even though the pipe joints may not be level with the ground. To provide proper support for the carriage whether it is rolling on the pipe or is in a raised position, two flexible arms are attached to the main frame. The frame has a sliding adjustment on two tube arms to compensate for varying distances of the tractor from the pipe. These slides are attached to the tractor at a single fulcrum point by means of a ball joint. An electric motor and a speed reducer are mounted inside the main frame to provide driving power for turning the pipe. Rotation of the pipe is accomplished by means of a roller chain that encircles it. Tension on the chain is maintained by means of a hydraulic cylinder arrangement, which is operated by a small hand pump and controlled by a quick release valve. The entire unit is suspended from the sideboom and is properly balanced, making it easy to handle. Also suspended from the sideboom is a flux box with flexible hose and check gate through which the flux is gravity

*Editor, Oil and Gas Pipelining.

EXCLUSIVE



Side view of main frame showing control panel and the welding wire spool.



Side view showing attachment of the welding unit to the tractor.

fed into a hopper on the welding head. This is the procedure for making a weld:

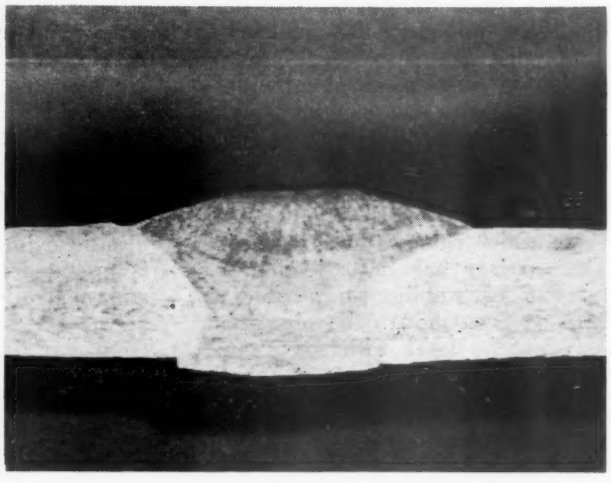
A length of pipe is set onto two dollies resting on skids on the ground by means of a sideboom tractor. An internal line-up clamp is then inserted in the pipe and the second joint lined up with the first and lowered onto a single dollie placed in the center of the joint. The tractor on which the welding unit is mounted is moved into position and the roller chain fastened around the pipe near the bevel between the two joints. By turning a crank on the side of the frame, the welding head is lowered onto the pipe. Two passes are made in approximately 4½ min, and, under normal conditions, the total time required to move the welding unit from one joint to the next is about 1½ min, thus the complete time cycle for each weld on 26-in. pipe is 6 min. The production rate, therefore, is 85 to 100 welds per 10-hr day with one machine when operating conditions on the right-of-way are normal.

While the work was in progress on Trunkline physical tests were made to determine the efficiency of the welds under field conditions. During the first two weeks almost every other weld was X-rayed. The opinion of inspectors was that the welds were equivalent in quality to longitudinal welds made in pipe manufacturing plants where conditions are ideal, leading them to believe that the adaptation of the submerged arc process to field practice apparently had not caused it to lose any of the high qualities generally associated with this type of welding. One of the reasons that this is so is because the machine operator has at his finger tips a control panel that makes it possible for him accurately to control amperage, voltage, and rate of feed of the welding wire.

Results of numerous tensile tests on welds produced by the process showed the welded metal to be stronger than the pipe, and bend tests of 180 deg had no effect on the weld.

Examinations of the micro-structure of the welds indicated that perfect fusion had taken place between the pipe and the weld. The reason for this is that, as the second pass follows immediately upon the first, the metal does not have a chance to cool, and the relatively high amperage produces sufficient heat to penetrate about two-thirds the way into the first weld, while the heat retained by the protective coating of slag completes the normalizing process to give the weld strength and ductility.

In the matter of efficiency, the use of multiple-joint sections enables the planned speed of pipe line construction to be set at a higher rate. This reduces the total construction time, with a corresponding reduction in total overhead. ★ ★ ★



Gamma ray of a weld made by the Smith process. Laboratory making test said: "Good density. No evidence of slag inclusions or gas pockets. Defects noted: None."

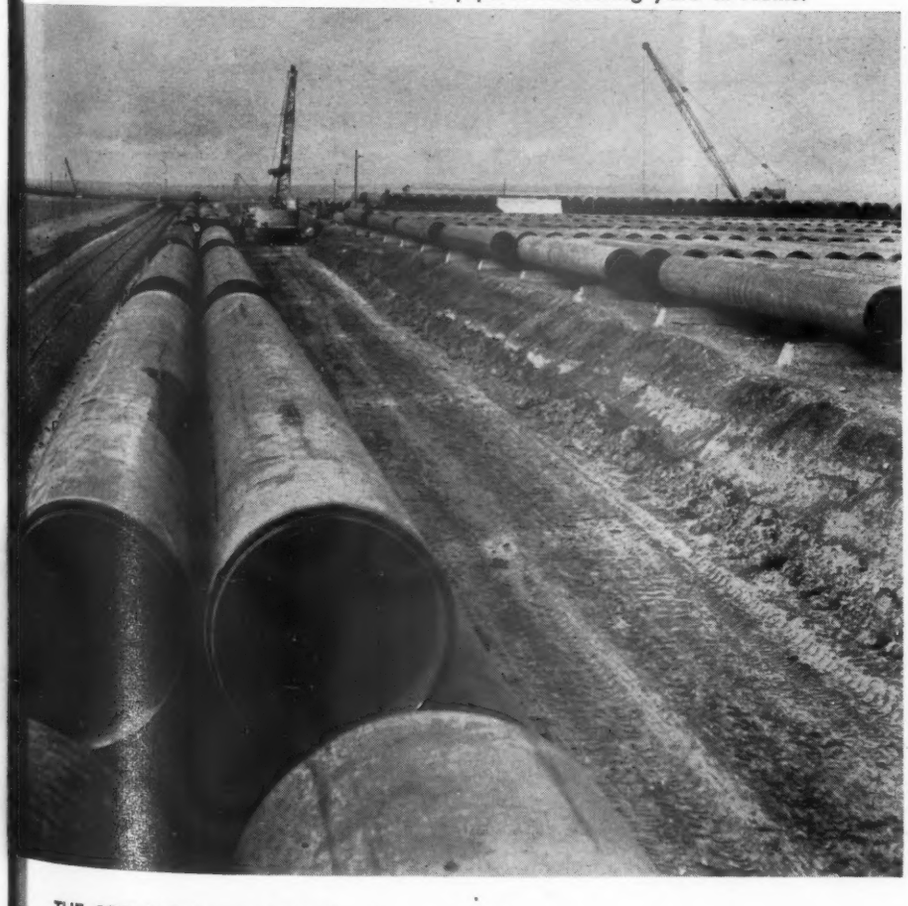
General view of Iraq Petroleum Company's depot at Homs.

Progress on New Iraq Pipe Line

Unsettled state of Iran's oil industry focuses attention on this important pipe line, construction of which is going ahead.

EDMUND UPDALE

A train load of 30 and 32-in. pipe in denesting yard at Homs.



EVENTS in Iran, where a big question mark overhangs the Abadan refinery, throw into sharp focus the great pipe line now under construction by the Iraq Petroleum Company.

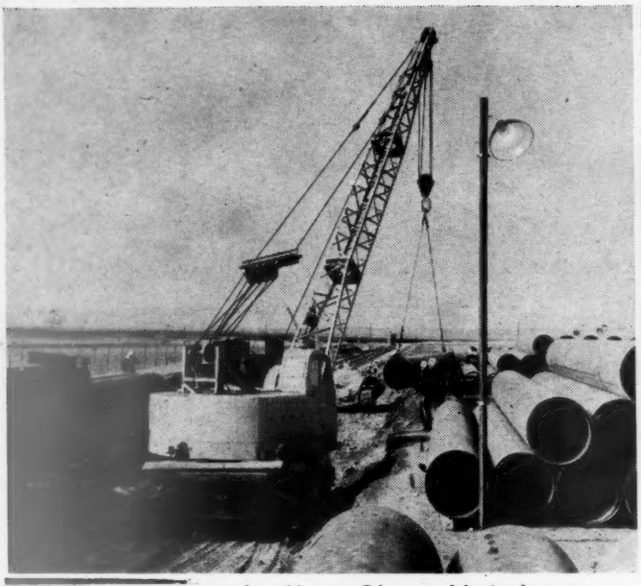
From its source at Kirkuk to its termination on the eastern Mediterranean seaboard at a point 2½ miles north of the sleepy fishing town of Banias, the line "tapers" in three sizes of pipe—32, 30, and 26-in. Cost of the project has not been disclosed, but it is likely to be well in excess of $150,000,000, and the result will be the almost trebling of the present tonnage of crude oil arriving every year at the coast to the south of the Banias terminal.

Capacity of the new line when full stream is attained in 1953 will be about 13,000,000 tons a year. The line is to follow the route of the existing 12 and 16-in. lines in operation from Kirkuk to the coast, until at Mile 494 in western Syria it branches northwest to make the angle toward Banias.

The eastern section of the pipe line, from Kirkuk to the Homs Gap, will consist of 30 and 32-in. pipe, in approximately equal proportions.

This larger section will carry the crude up to the gradual gradient from

EXCLUSIVE



Unloading pipe in yard at Homs. Observable is the manner in which the 30-in. pipe is nested in the 32-in.

Loading pipe onto a conveyor in yard at Homs.

Lining-up 30-in. pipe for welding in Homs yard.

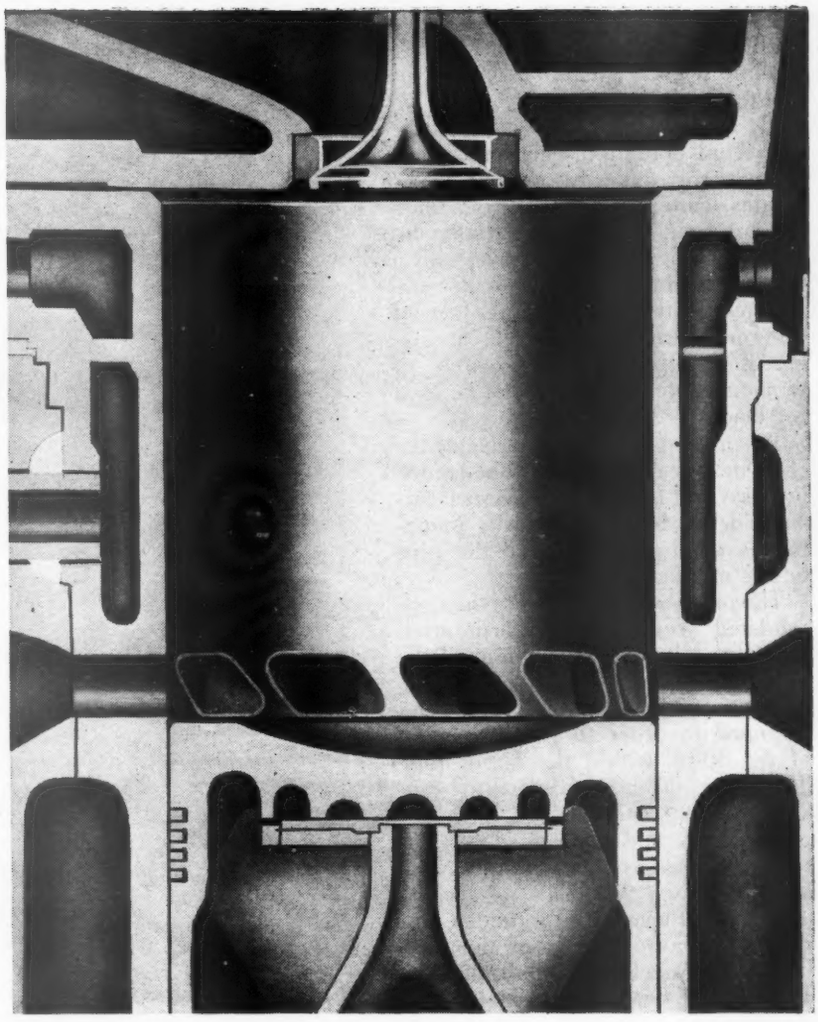
Making a finish weld on 30-in. pipe in Homs yard.

Re-beveling the end of a damaged pipe joint.

Hauling welding machines across Beka'a Plain, West Syria.

IT'S THE

Biggest News in Gas-Engine Compressors



The *vital power center*

that cuts down-time and increases efficiency in many gas and petroleum-processing services

For the first time, a vastly superior type of scavenging has been applied to compressor engines.

Worthington's timed scavenging system, built into the uniflo UTC-16, gives advantages far beyond any previous method.

A Thoroughgoing "Clean Sweep"

Here are some of the features of this new system concentrated in the "vital power center" illustrated above:

Complete removal of exhaust gas . . . more thorough charging with gas and air . . . positive timing for optimum combustion . . . effective supercharging . . . low operating temperature preventing carbonization . . . uniform cylinder temperature resulting in equal wall stress eliminating harmful stresses.

Many Uses . . . Many Sizes

While designed primarily as a pipeline gas-engine compressor, the UTC-16 is suitable for many other services, including: pressure maintenance on oil wells . . . in natural gasoline plants . . . in oil refineries, for solvent extraction, vapor recovery, recycling and stabilization of gases . . . in petrochemical processing of products made from natural gas under pressure . . . in many refrigeration applications.

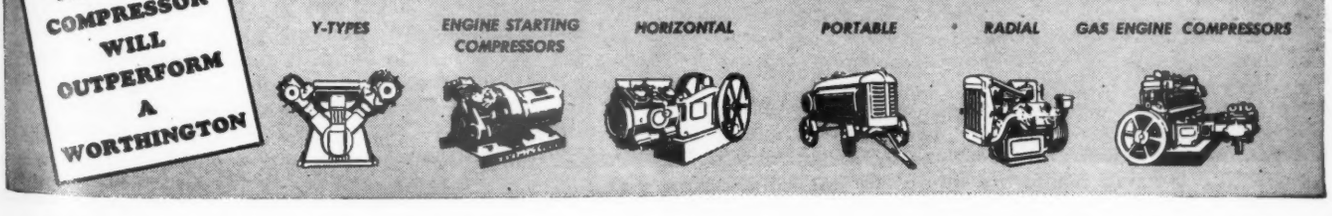
The Uniflo UTC-16 is built in sizes ranging from 800 to 2000 hp. For further proof that *there's more worth in Worthington*, contact our nearest Branch Office, or write the Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.

WORTHINGTON

ENGINE COMPRESSORS

EK.1.2

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



Kirkuk, and at the point where a gentle downward gradient begins the 26-in. line begins, extending on to the coast.

By the end of 1952 the line will be in partial operation, carrying a flow considerably under its capacity to the Banias loading point. Four sea-loading lines will be provided, to be increased to six at a later date, and a small servicing harbor is to be constructed on the mile-long frontage of the coast terminal. This will accommodate small craft only, probably up to about 50 tons, and will not be used for loading.

When crude begins to arrive at the coast next year, tankers will be loaded by gravity, but in due course this method will be superseded by pumping as the full capacity of the pipe line is attained.

The pipe was ordered from the Consolidated Western Steel Corporation of Los Angeles, and the National Tube Company of Lorain, Ohio. Equal proportions of 30-in. and 32-in. pipe were arranged in order to permit nesting of the 30-in. within the larger pipe during transit and until required separately on the sites.

The 30-in. and 32-in. pipe is welded longitudinally, but the 26-in. is seamless. Forty-two ships were chartered from Furness, Withy and Company for transportation of the pipe from Los Angeles and Baltimore to Tripoli (Lebanon) and to Basrah, in the Persian Gulf.

For movement of pipe and other equipment in the field a special fleet of 35 Mighty Antar trailer outfits, Britain's biggest, is being used. These units are capable of a gross laden weight of 100 tons, and as solo vehicles can carry loads of 32 tons.

The project involves 1,500,000 ton-miles of transport a month, over desert tracks and sandy wastes. Railways are also being used to transport the pipe to unloading points along the line.

Work on clearing the right-of-way and on road construction for the 26-in. section of the line began in September of last year. The first 26 in. pipe was shipped from Baltimore in October, and stringing and welding began in November. To date, 91 miles of 26-in. and 321 miles of 30 and 32-in. pipe have been shipped.

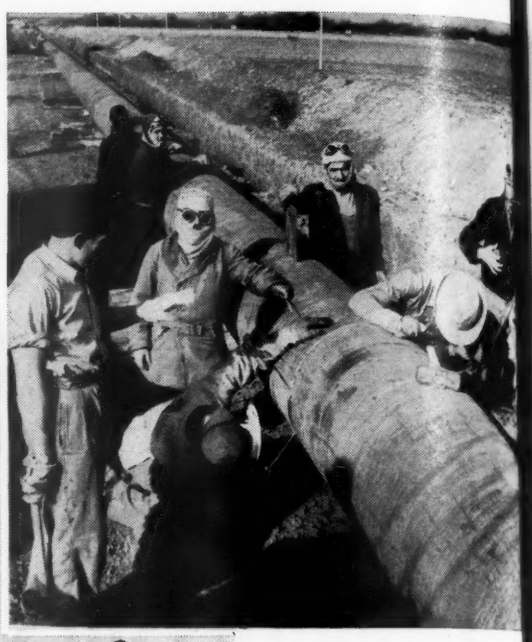
The general contract, under the Bechtel Corporation, and subcontracts for ditching and other work, covers the employment of approximately 5500 local workers and about 300 to 400 personnel, mainly technicians, from Europe and the United States. Total tonnage of pipe required for the project is 168,000, of which 145,000 tons are 30 and 32-in.

Conveyance of the pipe inland from the ports involves in all 25,000,000 ton-miles of rail transport and 25,000,000 ton-miles of motor transport across the Iraq and Syrian desert country, in temperatures that vary from 20 F in the winter to 120 F in the summer.

The Iraq Petroleum Company at present has no plans for the construction of a refinery, but it has recently been reported that the Iraqi government has accepted the tender of M. W. Kellogg Company of New York to build its first state-owned refinery, south of Baghdad, the capital.

It will produce 1,000,000 tons a year, and cost about $204,000,000, Abdul Mahmoud, Iraqi minister of economics, reported. * * *

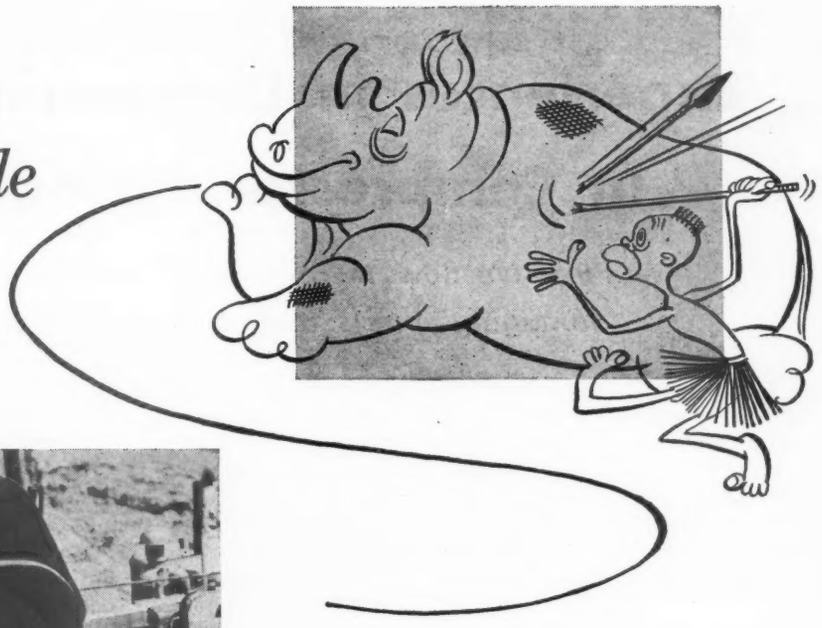
Running a stringer bead on 26-in. pipe.



Stringing 26-in. pipe across the Beka'a Plain

Erecting temporary houses for the construction staff.

Like the Rhino's tough hide that protects what's inside...



Johns-Manville Asbestos Felt protects oil and gas pipe lines

MORE than 100,000 miles of oil and gas pipe lines are now protected by Johns-Manville Asbestos Pipeline Felt—*the only type of wrapper that has survived over 50 years of service in all types of soils.*

Johns-Manville Asbestos Felt is a sturdy, inorganic product. It has the thickness and toughness necessary for shielding pipeline enamels from earth load and soil stresses. It is resistant to rot and decay, and to acid and alkali soils. It permits the protective enamel coating to properly function against corrosion.

Johns-Manville Asbestos Felt is flexible. It wraps easily without cracking. It guards enamel from impact during installation of field-wrapped pipe, or during transportation and installation of mill-wrapped pipe.

There are economic advantages, too. In addition to reducing maintenance expense, Johns-Manville Asbestos Felt adds many years of life to the pipeline. For further information and a sample of Johns-Manville Asbestos Pipeline Felt, mail the coupon below.

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City_____ Zone____ State_____

Experiences in Dampening Pulsations In Compressor Piping Systems†

Pulsative flow in compressor station piping can have damaging effects and warrants serious consideration

M. L. ARNOLD*

IT IS PROBABLY unnecessary to remind a group such as yours, of the possible ill effects of pulsative flow in compressor station piping. But, for the record, they may be summarized as follows:

1. Fatigue failure of piping and heat exchanger tubes.
2. Erroneous measurements of gas streams entering and leaving station.
3. Reduction in volumetric capacity of compressor cylinders.
4. Increase in horsepower requirement per unit volume of gas pumped.
5. Increased cost per brake horsepower of installed capacity.

The list is formidable and warrants your serious consideration of the phenomenon of pulsative flow, what it is, why it occurs in compressor station piping, and what measures may be taken to eliminate it, or to at least mitigate its ill effects.

In retrospect, it seems that for most of the 28 years I have spent in the natural gas industry, my life has been plagued by problems attributable to pulsative flow. The phenomenon usually evidences itself by the vibrations it sets up in piping. I can recall that, as a member of the labor gang, we spent a considerable portion of our time in bracing and tying down piping in an endeavor to stop it from shaking.

After two or three years in the construction and operating departments I was transferred to gas measurement work. The transfer came at the time the gas lift method of producing oil wells was coming into general use in the Signal Hill field of California. The compressors used for this purpose were of about 100 bhp capacity, steam driven, and operated at about 250 rpm. They compressed gas from about 30 psig to 500 psig. It was very disheartening to us in the measurement department, to find that as often as not, the gas meters we so carefully installed to measure the output of these plants, showed that gas was flowing to them through the compressor discharge line and leaving through the suction line. We suspected then, and now know, that this startling misinformation was one of the effects of pulsative flow in the gas line. Gas measurement being what it was, we of course had no inkling of the effects pulsative flow might be having upon the capacity of the compressor cylinders, or upon the power required to compress the gas.

But these past troubles paled into insignificance when in 1941 we began our North Coles Levee gas injection plant. This plant consisted of six 600-hp, 2-cycle, direct connected, right angle, gas engine driven compressors. Each unit has six power cylinders and three compressor cylinders. Gas was compressed from 400 psig to 3400 psig in two stages. Two compressor cylinders on each engine were used on the first stage, and one on the second stage. The plant had been, we thought, carefully engineered and designed, but when it was placed in operation very heavy vibrations developed in the double expansion U bend, which had been used to absorb movements due to thermal expansion and contraction of the piping.

The seriousness of the situation caused me to make a very hasty, but fairly comprehensive investigation into the causes and effects of vibration, and means for controlling it. By applying some of the information acquired, we were able to reduce the amplitude of vibration to what were believed safe limits, largely through the installation of spring type vibration dampeners on the piping. The findings made in this investigation were reported in a paper presented to a joint meeting of the California Natural Gasoline Association, and the Southern California Section of the American Society of Mechanical Engineers in December 1944.[1]

Even though, as stated previously, we were reasonably certain that the amplitude of the movements of the piping was being controlled within safe limits, we could not be certain that this was the case. We were, therefore, anxious to determine accurately the causes of the vibrations and eliminate them if possible. In 1945 the engineering firm that had designed and constructed the plant informed us they had completed development of a device that they believed would eliminate our trouble, if the cause of the vibration was pulsative flow. Neither they nor we knew, however, whether the vibrations were the result of the pulsative flow of gas, or of mechanically transmitted forces originating from the reciprocating parts of the engines, or a combination of the two. We therefore decided to make a joint survey of the plant for the purpose of determining this. Before describing the methods employed in the survey, or describing the corrective measures proposed if the cause were found to be pulsative flow, a very brief discussion of the phenomena occurring in the compressor piping will be given.

It is well known that gas does not flow from a compressor cylinder in a continuous steady stream. It emerges in what Murphy has described as "puffs." The magnitude and duration of these "puffs" is a function of the cylinder size and clearance and the compression ratio. The frequency of the puffs is a function of the compressor speed in revolutions per second, and is twice as great for a double-acting cylinder as for a single-acting cylinder.

When these puffs of gas are emitted into the discharge piping they compress the gas in the immediate vicinity of the compressor discharge valves and cause flow in the line away from the cylinder. The velocity of flow varies and is a function of the instantaneous rates at which the puffs are emitted, and the cross-sectional area of the pipe. This also originates a compression, or pressure wave that travels through the pipe at the velocity of sound in the gas. This pressure wave may be reflected and travel back along the pipe in a direction opposite to the gas flow.

†Presented before spring meeting, Natural Gas Department, American Gas Association, Dallas, Texas, May 7 and 8, 1951.

*Chief Engineer, Gas Operations, Richfield Oil Corp., Los Angeles, Calif.

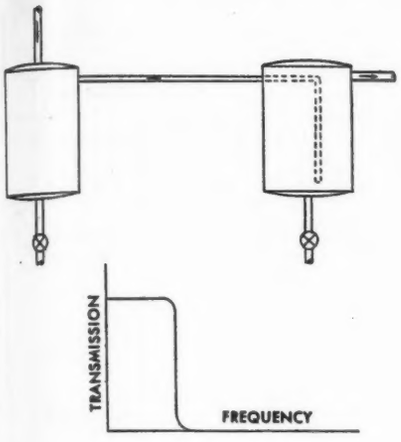


FIG. 1.

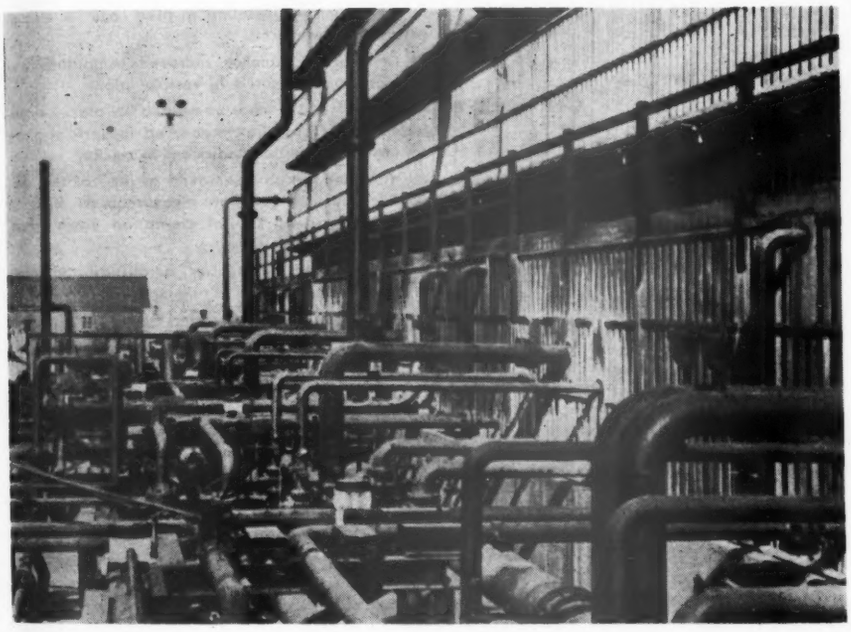


FIG. 2. Station "A" above and Station "B" at left.

The frequency at which the puffs are emitted is a function of the compressor speed in revolutions per second, and further depends upon whether the cylinder is operating single acting or double acting. If two or more cylinders use a common line, the frequency of puffs is also a function of the crank angles between the various cylinders and the number of cylinders.

If two compressors are discharging into a header, the frequency of the puffs may or may not be the same as for one compressor. If both compressors are identical and the cranks are all in phase, then the frequency will be the same as for one compressor. If the cranks are 90 degrees out of phase, the frequency will be doubled. If the cranks are alternately in phase, then out of phase, a variation in frequencies occurs that is known as a "beat frequency." Obviously, the more compressors, the more possible frequencies exist. The puffs taken into the cylinder caused a rarefaction, which creates similar disturbances in the suction line. In both cases, the frequency of the pressure waves generated is the same as the frequency at which the puffs are emitted into or withdrawn from the line or system.

It is evident from the foregoing discussion that two phenomena exist in the compressor piping. These are:

1. A pulsative flow of gas away from the cylinder in the discharge line and towards the cylinder in the suction line.

2. Pressure waves which may be traveling in both directions in both lines.

Both these effects may be detrimental to good compressor operation. In our case the immediate concern was with piping vibration. Concerning this Murphy[4] has stated that "... serious vibration of the piping, if present, usually occurs at a relatively unsupported bend far from the compressor. Such a bend may behave as a Bourdon tube pressure gage, and it must change the momentum of the gas. Its frequency as a mechanical vibrating system may chance to coincide with the acoustical frequency and thus aggravate the difficulty." Essentially this states that the pulsative flow of gas, rather than pressure waves, is responsible for piping vibrations. We held the same opinion at the time. Had we considered that pressure waves were responsible, we would have been less reluctant to accept the proposal that had been made to cure the vibrations.

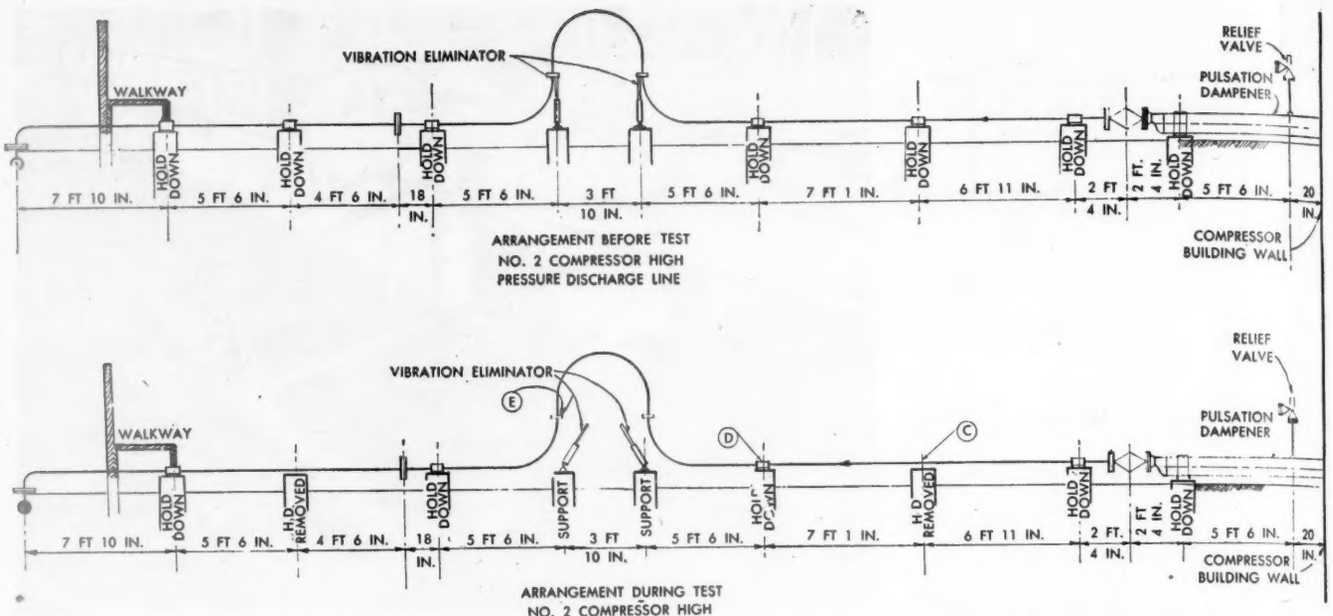
Acoustical filters have long been used to suppress the pressure waves (sound) created by the air intake and the exhaust of gas engines. But to the best of our knowledge, such a filter had not been used to suppress the effects of pulsative flow, yet that was the remedy suggested by the contractor. The filter proposed consisted of two volume chambers connected by a length of tubing of smaller diameter. The gas was to flow through the three elements in series. It is shown diagrammatically in Fig. 1, and has been described by Stephens.[2]

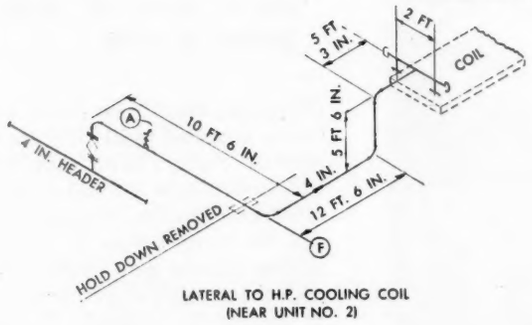
The relationship between the size of the volume chambers (V), the length (L), and radius (R), of the interconnecting tube, and the cut-off frequency (F) of the device is expressed by Stephens as follows:

$$\frac{L}{R^2} \times V = \frac{C^2}{78.674F^2}$$

In which:

L = the length in inches of the passage in pipe





A—Pressure pick up installed at plug cock for all pulsation measurements.

C—At time of test anchor removed: Amplitude and acceleration measured in vertical plane.

D—At time of test anchor remained in place; amplitude and acceleration measured in vertical plane on pipe immediately adjacent to anchor.

E—Vibration eliminators removed at time of test; amplitude and acceleration measurements made in vertical plane on top of clamp on down-stream side of loop.

F—Anchor removed during test; amplitude and acceleration measurements made in horizontal plane at ell.

FIG.3.

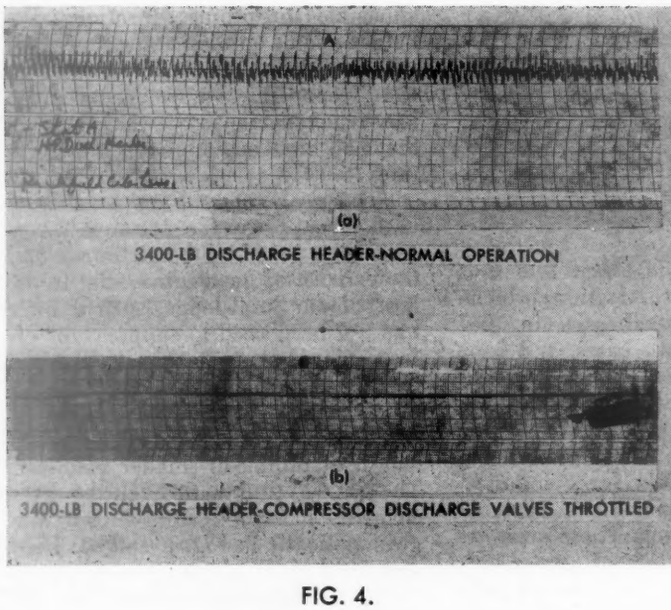


FIG. 4.

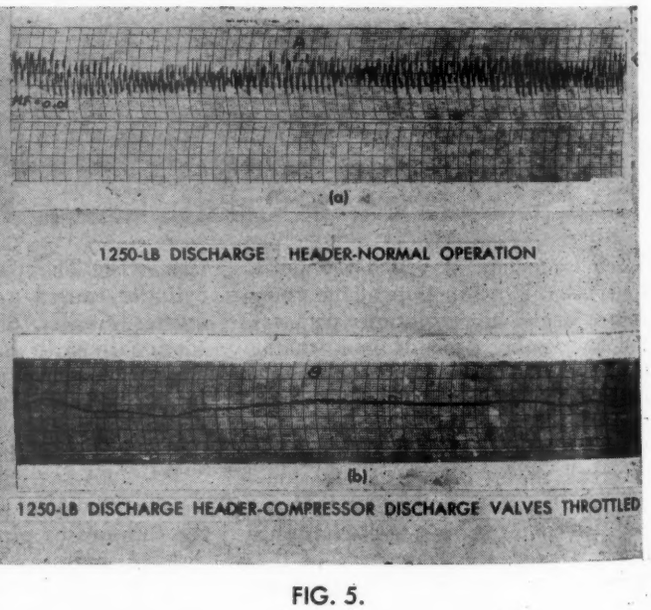


FIG. 5.

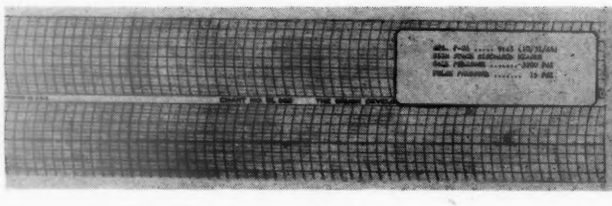


FIG. 6.

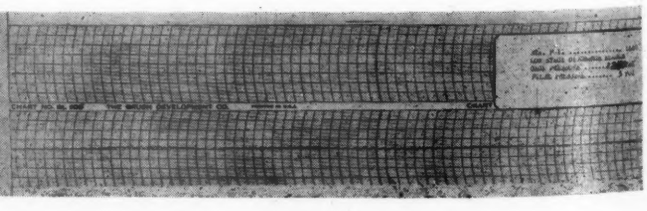


FIG. 7

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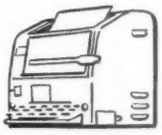

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R = radius in inches of that passage

V = the volume in cubic inches of one of the equal volume chambers

C = net velocity as defined below, in feet per minute of sound in the gas and of the gas stream in pipe

F = fundamental frequency per second of pulsations created in the gas line by the compressor and at the compressor outlet.

This and one other type of acoustical filter is discussed by Hirschorn,[3] who presents similar equations.

It was reasoned that a pinched valve in the compressor discharge line would be the rough equivalent of the $\frac{L}{R^2}$ term, and that the compressor surge bottle upstream of the valve and the lateral downstream of the valve would approximate the chambers V to a sufficient degree to allow us to determine whether our trouble was indeed caused by pulsative flow and could be corrected by the installation of the proposed device.

Before making the test, all mechanical vibration dampeners were removed from the piping and observation made of the acceleration and deflection of the piping at various points. A recording was made of the pulsations occurring in the discharge headers of both stages. General views of the piping and the location of the points at which these recordings were made can be seen in Figs. 2 and 3.

TABLE 1.

Station	Acceleration, per cent of original	Displacement, per cent of original
C	46	19
D	32	33
E	23	10
F	18	12

Then the shut-off valves in the 3400 psig discharge lines were pinched sufficiently to create a 220 psig pressure drop, and the corresponding valves in the 1250 psig discharge lines throttled to create a drop of 120 psig. After throttling, it was found that the acceleration of the piping had been reduced from 19 to 38 per cent. These are tabulated in Table 1.

The charts in Fig. 4 show the change in pulsations in the 3400 psig header, and those in Fig. 5 show the corresponding changes in the 1250 psig header.

These results indicated to us that the devices would be effective, and we contracted for their installation. Figs. 6 and 7 show the pulsations in the headers after the change. The recording was made at the same points as shown in Figs. 4 and 5. The pressure drops through the dampeners were approximately 10 per cent of the pressure drops that had been required across the pinched valves. The results were entirely satisfactory. We later decided, however, to rotate the vertical expansion loops in the laterals to the horizontal position to eliminate a small amount of vibration believed to be due to mechanically transmitted disturbing forces originating from acceleration of the reciprocating parts of the engines.

Our next application of pulsation dampeners was made solely for the purpose of improving the gas measurement at a natural gasoline plant. This plant was served by five horizontal, 250-bhp compressors, each operating at 200 rpm and each equipped with two double-acting compressor cylinders. The gas was boosted in two stages from an inlet pressure of 15 psig to a final discharge pressure of 450 psig. The intake meter was approximately 100 ft distant from the point of connection of the field line to the compressor suction header. In order to obtain a readable chart it was necessary to place a restricting orifice in the manometer tube. The resultant reading, however, could not be made to agree with the sum of the field meters. Pulsations from the dis-

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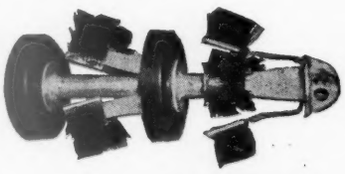

8" Size—TYPE WC-11—8" to 14" will traverse 6 foot radius field bends, full diameter side openings at 45°.

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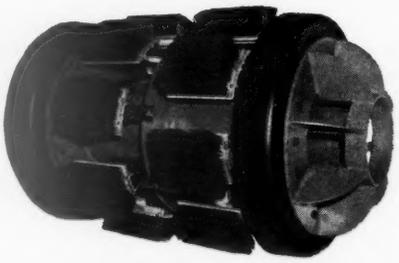

20" Size—TYPE GP-2—16" to 30" 200 lb. SPRING forces the brushes against pipe wall—COMPENSATING for WEAR. Will traverse round opening gate or plug valves.

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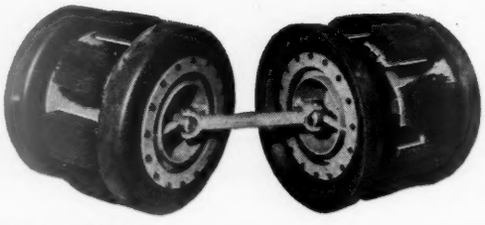

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charge side of the compressors had a similar bad effect upon some of the plant process meters.

There are several ways in which pulsative flow may affect orifice meters. If the frequency of the pulses approximates the natural frequency of the manometer, the mercury may be forced into violent oscillations. The natural frequency of most mercury manometers is low enough to avoid this. The pulse frequency is given by the following formula:

$$\frac{360°}{\text{C.A.}} \times \frac{\text{RPM}}{60} = \text{frequency}$$

C.A.—Maximum crank angle between compressor cylinder, including apparent crank angle of each cylinder which is:

Single Acting — 360°

Double Acting — 180°

Frequency = pulses per second

TABLE 2. Comparison of Voissel's calculated and experimental resonant frequencies with those observed on analogous circuits upon the network calculator.

	Voissel		Equivalent circuit on calculator (rpm)
	Calculated (rpm)	Experimental (rpm)	
I. Plain pipe, 22.5 meters	228	260	260
II. Plain pipe, 26.0 meters	198	220	222
III. Plain pipe, 24.6 meters	209	218	222
IV. Plain pipe, 24.6 meters, sharper elbow	...	210	219–222
V. No suction valve plain pipe, 24.6 meters, sharp elbow as in No. IV	209	217	(219–222)
VIII. Surge chamber 2.88 meters from compressor, total 24.6 meters of pipe		170	172–173
IX. Surge chamber 7.42 meters from compressor, total 24.6 meters of pipe	...	178	180–182

Even if the disturbance is small, however, it may have a serious effect upon measurement if the frequency of the oscillation is in resonance with the recording system, or some component of it, such as the pen and pen arm.

Another effect may be caused by the manifold, meter piping and meter pots. Reference to Fig. 1 brings out the similarity of orifice meter piping to a pulsation dampener. The meter manifold upstream of the orifice represents one volume chamber, the upstream meter pot represents the other. The meter piping, which is usually of small diameter, represents the connecting tube. A similar construction exists downstream of the orifice. These, as explained before, constitute low pass acoustical filters. If they are not identical, the pressure waves acting on the mercury in one pot will differ from those acting on the mercury in the other pot, and serious errors in measurement may result.

In our case, the installation of a single pulsation dampener in the field line between the meter and the suction header cured the difficulty. A similar installation made in the plant discharge line stopped the interference with the plant process meters.

Both the users and the manufacturers of compressors have long been concerned with designing compressor piping to give optimum compressor performance. Thiel[5] has proposed a method for sizing suction and discharge laterals. One compressor manufacturer, upon request, supplies its customers with a manual for sizing headers, laterals, and cylinder surge chambers. Both of these treatises are concerned with minimizing pressure loss due to gas flow. Neither considers the possible ill effects of pressure waves. Probably the most complete treatise on the subject is contained in the doctoral thesis prepared by Eugene Murphy.[4] In his introduction he states:

"Sometimes the compressor delivers more gas than expected but at the expense of more than proportionately increased power requirements, possibly exceeding the capacity of the installed motor. More often the rate of

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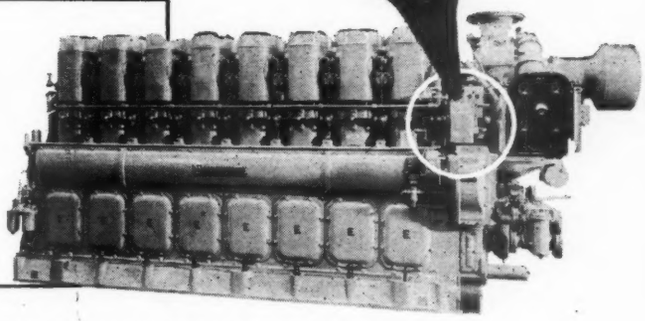

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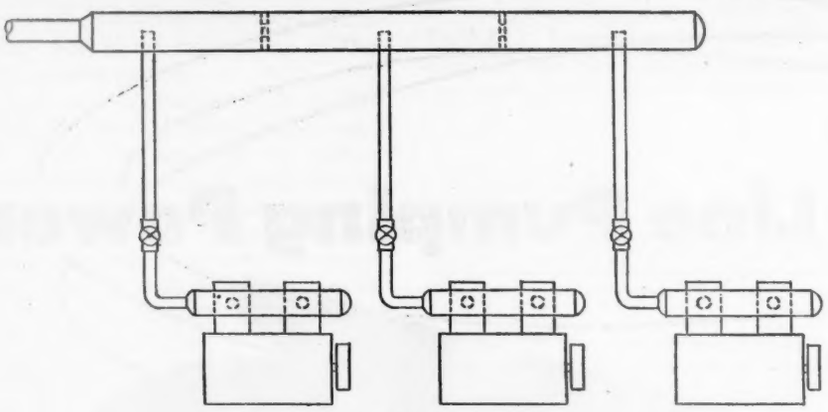


FIG. 8.

gas delivery falls below that guaranteed by the builder, although the amount of energy required per unit of gas actually delivered may again be above that normally expected for the pressure conditions measured in the lines far from the compressor.

"In perhaps the most disturbing cases, the power requirements fluctuate, causing 'hunting' or rapid variations in speed, which the prime mover governor cannot control. Similarly, there may be sharp variations in current (and line voltage) in the case of synchronous electrical motors driving compressors. Internal combustion engines sometimes show similar deviations from designed power output, increased fuel consumption and exhaust gas temperature, and occasionally periodic variations in speed.

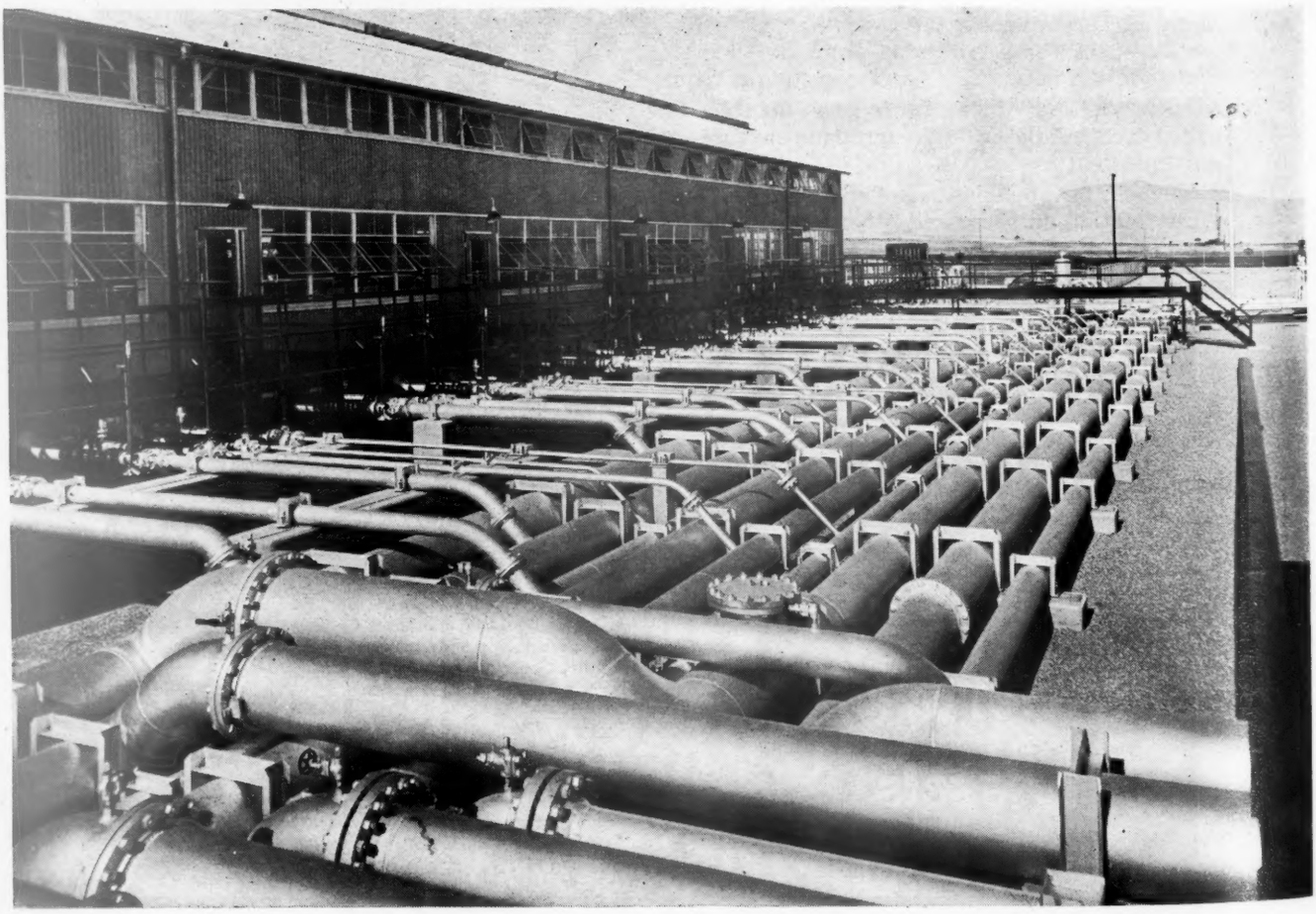
"These difficulties are believed to be due to resonance between the fundamental or a harmonic of the pressure wave set up by the intermittent intake or discharge of gas and the natural frequency of all or a part of the gas piping system. Initial difficulties in the cases considered are due to vibration of the gas as in a complicated system of organ pipes."

Murphy has developed a method by which the natural frequency of vibration of even the most complicated system of piping may be determined. The system is broken up into "lumps" of pipe. The length of the lump is from 1/10 to 1/20 of the wave length for the suspected natural frequency. Through the use of electrical analogues and scale factors, the natural frequency of the piping system is then computed. If this is done during the design stage, and the system is found to be in resonance with the fundamental frequency of the compressor cylinders, or an important harmonic thereof, design can be changed to avoid this.

From Murphy's work it can be concluded that orifice plates and the resistance of the piping has little effect on the natural frequency of a piping system. Surge chambers, however, have a very pronounced effect in lowering the natural frequency of the piping system. Some of Murphy's results compared with Voissel's results on a single cylinder compressor are shown in Table 2, in support of this. Concerning use of surge chambers he states,

"When resonance occurs in practical systems, the owners or designers usually feel that a larger surge chamber (or manifold in the case of multiple cylinders) is needed. The supposition is that no resonance would take place if the pipe between the cylinder and the entire atmosphere were negli-

FIG. 9.



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gibly short, so that puffs of gas would immediately dissipate in the atmosphere. The addition of a fairly large surge chamber near the cylinder is thought to approach the desired effect. The flow in the secondary pipe beyond the surge chamber is assumed to be smooth and substantially non-oscillating.

"The experiments by Voissel and Farmer and the analogous electrical studies here reported as well as the studies on generalized systems, reported below, indicate that such a simple picture may be misleading. Surge chambers should be added or increased in size only with the knowledge of the existing natural frequency of the entire piping system.

"Misguided addition of surge chamber volume might merely lower the natural frequency from a value somewhat above resonance with the important harmonic of the compressor speed to substantially that harmonic. Then the total pulsation of the gas would be increased from a substantial forced oscillation to a more severe resonant vibration."

He also comments on the use of filters as follows:

"The analogy might be used to design acoustical filters or mufflers designed to pass the direct flow with minimum pressure drop, and yet to reduce (attenuate) the oscillating components over a reasonable range of compressor or engine speeds. The aim would be to use minimum resistance but properly proportioned inductances and capacitances. Any proposed design of filter could be checked in analogous electrical form. The extensive information on electrical filters (chiefly for telephone and radio service) could be transformed into acoustical terms. Unless such a filter is contemplated, however, the frequent practice of designing surge chambers in a certain ratio to the volume of the cylinders without regard to the remainder of the piping seems hazardous."

In our latest plant one of the volume chambers of the pulsation dampener is used as the surge chamber, at each unit. The other volume chambers are laid end to end and, separated by orifices, they comprise the header. The tube connecting the volume chamber situated in the header with the volume chamber at the compressor thus becomes the compressor lateral. This arrangement has also been described by Stephens.[7] It is shown diagrammatically in Fig. 8. A photograph of the piping is shown in Fig. 9. Note the absence of expansion bends. Suitable provision for lateral and longitudinal movement of the piping makes their use unnecessary.

We have not actually checked the performance of the compressors using pulsation dampeners or the dampening system by means of indicator cards. This is due, in part to the difficulty of obtaining accurate cards on the type of machine being used, and in part to the lack of an indicator for use in the higher pressure ranges. The output of the compressors, however, is essentially that which would be predicted from the header pressures. And fuel consumption and exhaust temperatures indicate that the engines are not overloaded when operating at a rated speed and at rated compressor suction and discharge pressures. Because of this, and the vibration-free piping it assures, we have become consistent users of pulsation dampeners on all permanent compressor installations.

References

1. Arnold, Marion L., "Vibrations in Compressor Piping." Presented before California Natural Gasoline Association, December, 1944. Published in *The Petroleum Engineer*, Reference Annual (July 1) 1945; *Oil and Gas Journal*, January 6, 1945.
2. Stephens, Foster M., U. S. Patent 2,405,100.
3. Hirschorn, Martin, *Chemical Engineering*, September, 1949.
4. Murphy, Eugene F., Doctoral Thesis, Illinois Institute of Technology, June, 1948.
5. Theil, B. C., *The Petroleum Engineer*.
6. Murphy, Eugene F., *California Oil World*, First Issue, February, 1949.
7. Stephens, Foster M., U. S. Patent 2,474,555.

★ ★ ★

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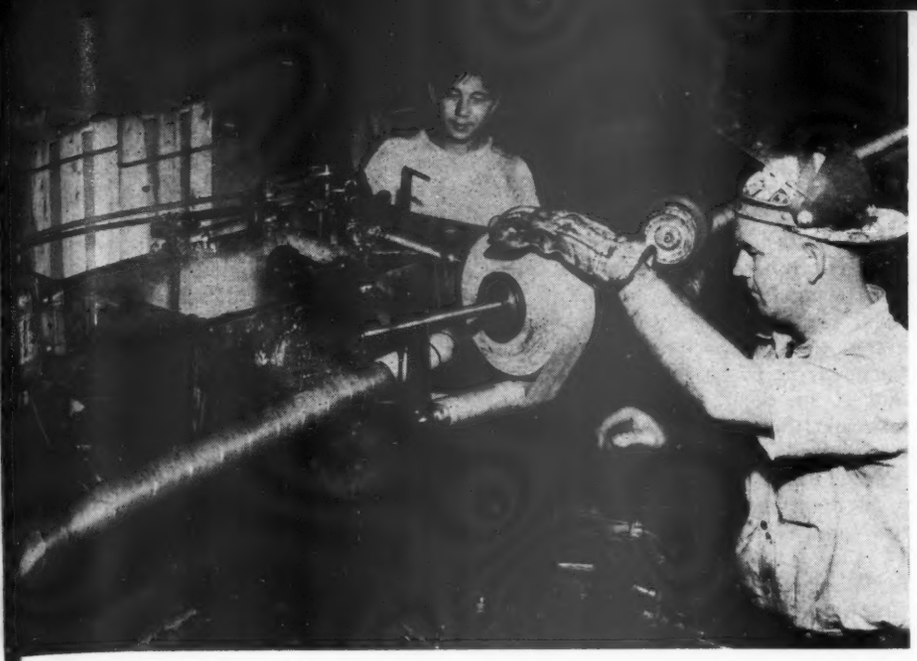

New machine in action.

Development In Coating and Wrapping Pipe

Portable machine devised to apply No-Ox-Id materials to pipe, previously done by hand

HARRY T. BURROWS*

OWING to the increasing demand for coating and wrapping all sizes of underground pipe, the Dearborn Chemical Company, Honolulu, Hawaii, designed and built a portable machine under the direction of the writer. The machine is for coating and wrapping with No-Ox-Id materials, previously done by hand. It is similar in construtions to the standard engine screw cutting lathe.

The bed is 28 ft long, 36 in. wide, consisting of two 7-in. I-beams, having two 2-in. angle irons welded on the top of each I-beam. To make the bed ways, suitable, 5 by 5 H-beams 36 in. long were welded on the underside of the I-beams making cross-braces every 4 ft; ¼ in. by 1½ in. flat iron was used as diagonal braces between each cross member.

An 18-in. lathe head and tail stocks, after adding sufficient raiser blocks, gave a swing of 30 in. and a length between the centers of 23 ft.

The carriage was formed from ½-in. flat steel 3 ft by 4 ft square having three 3-in. groove ball bearing rollers that roll on the inverted 2 by 2 angle iron or ways. The carriage is moved back and forth on the bed by an endless chain situated in the side of the front I-beam. This chain has a ¾-in. pitch, is driven by a 3-in. sprocket, and runs over a 3-in. idler at the rear of the machine. The chain is supported on ½-in. square steel the full length of the machine. The drive is transmitted through miter gears that in turn are driven by ½-in. pitch chain sprockets at the head end of the machine. One sprocket, a permanent one, is attached to an extension, which was added to the head stock and serves as a drive gear to the feed table. The second, a lower sprocket, is attached to a hub and is removable and interchangeable with sprockets of different sizes to control the speed of the carriage per revolution of pipe being wrapped. This is necessary as the pipe varies in diameter—also the width of wrapping material being used varies. No adjustments have to be made other than the selection of the proper drive sprocket, which moves the carriage to the required distance to give a proper lap of the wrapping material per revolution of pipe. The machine is so designed to be able to coat pipe ½ in. up to 30 in. by merely moving the two spools holding the wrapper and kraft paper and the hot tanks back to allow the larger diameter pipe to be placed in the machine.

Should the pipe vary in length, the tail stock is moved back and forth as on a standard lathe. Due to the great heft of the tail stock assembly, together with the necessary raiser block to give a 30-in. swing, it was found advisable to build a special sprocket drive and rack and pinion arrangement whereby the operator can move the tail stock assembly by simply turning a crank, which being a very low gear requires little labor.

For larger pipe, over 2 in. in diameter, the conventional tapered live center is used on the tail stock, but it was found that this put a bow or bend in the smaller diameter pipe, when sufficient pressure was applied by the tail stock screw. As a result a universal three-jaw chuck with ball and thrust bearings was arranged, fitting it to the tail stock quill using a taper pin through the quill to prevent this assembly from becoming disengaged from the tail stock. Then instead of tightening the tail stock against the end of the pipe, the three-jaw chuck was tightened and then pulled back tight, which action tends to take most of the slack out of a small diameter pipe.

The movement of the carriage is controlled by two levers, which engage the driving chain, causing the carriage to travel back and forth on the lathe bed. One lever operates the carriage in one direction and the other moves the carriage in the reverse direction.

A special blocking device is built into the apron that prevents both levers being engaged at once.

The machine is powered with one ¼-hp. motor, having a speed output of 15 rpm. This power is transmitted through two V-belts to a countershaft, which in turn drives the head stock. The countershaft is driven by the two V-belts from the motor and in turn drives the head stock through three V-belts.

The head stock has four flat steps whereas the driving pulley on the countershaft is a V-groove.

The entire assembly of motor bracket and countershaft are arranged on one common hinge, thereby making it possible to swing both the motor and the countershaft to accommodate different lengths of belt when changing speeds of the head stock. The same diameter driving sheave is used on the countershaft. When changing speeds on the cone pulley, the three-groove sheave is slid along the countershaft opposite the particular step desired on the head stock.

The carriage is equipped with suitable brackets upon which are mounted

*Consulting Engineer, Dearborn Chemical Company.

EXCLUSIVE

the spools of wrapping material being used. These are placed on the front side of the carriage. The wrapping material is mounted on adjustable spools, which in turn are attached to the brackets on the machine carriage. These brackets are so mounted that they may be adjusted to the proper angle required by the particular width of wrapper and the diameter of pipe being wrapped. The shaft of each spool is equipped with a 4-in. V-groove pulley in which is laid the tension rope to act as a brake. This insures the proper tension of the wrapper while being wound on the pipe.

On the far side of the traveling table is a large electrically heated tank arranged with power driven gear pumps to irrigate the material onto pipe and wrapper.

This tank is divided into two sections, making it possible to treat the pipe with two separate types of material. The electrical heating elements are thermostatically controlled.

Both gear pumps are placed inside the tanks close to the bottom, so they are always submerged in the material and, therefore, do not become plugged or chilled. The piping is arranged with adjustable bypass valves and swivel joints, making it possible for the hot fluid material to be flowing constantly, either irrigating the pipe or returning back into the tank.

The bypass valve controls the amount of material used on the pipe and due to the constant flow of material through these pipes it is never allowed to clog up.

The materials used at this time are:

No-Ox-Id XX, which is kept at a temperature of 180 F by electrical immersion heaters are situated parallel to and close to the bottom of the tank. There are three 1000-watt heaters in this compartment. Each compartment is 18 in. by 18 in. square and 16 in. deep. It has been found, however, that usually only one heater is required after the entire tank has become fluid.

In the remaining compartment of this tank, No-Ox-Id Service Coat No. 14 is used, which has presented a different problem insofar as heating is concerned. In this compartment, which is the same size as the one previously described, there are four 1500-watt heaters, arranged in a row inside the tank across the bottom. There also is a sub-space under the tank in which are ten 250-watt Strip heaters. This portion of the tank is completely insulated on the lower side with spun glass. The four immersion heaters and the 10 Strip heaters are all in series with a separate thermostat control having a range from zero to 500 F. The equipment usually is begun with all immersion heaters and the Strip heaters in operation, the thermostat being set at 350 F; however, after the material has become fluid, all the heaters may be disconnected except 10 Strip and one immersion heater.

The Service Coat No. 14 is preheated in the conventional roofing tank, supplied with bottle gas. This material is transferred from the preheating tank to the machine via buckets as it is required. The tank pumping device and nozzles are such that any of the other grades of No-Ox-Id can be used without further adjustment.

The gearing of the drive train controls the amount of lap during the wrapping of the pipe. In wrapping the smaller diameter pipe, it was found necessary to install a steady rest to keep the long pipe from whipping. The 2 three-jaw universal chuck did help to hold the pipe steady, but not sufficiently to resist the side strain of the wrapping material while it was being applied to the pipe.

To overcome this, two cam operated steady rests were designed. These rests are arranged with two aluminum rubber tired rollers, one large and one small roller on each steady rest.

The steady rests are placed near the center of the machine and are 6 in. farther apart than the entire width of the carriage and are made to raise and fall by a cam and roller action that is placed on the lower lip of the carriage apron. When the pipe is placed on the machine and both front and rear chucks are tightened, the farther or rear steady rest is in a working or vertical position and supports the pipe on its two rollers. As the carriage advances, the lead cam on the apron causes the other steady rest to begin to rise and as the carriage passes over this point, the steady rest continues to rise until finally it, too, is in a vertical position and also supporting the pipe. The carriage then has 6 in. farther to travel before it engages the mechanism to retard the second steady rest. This motion removes the steady rest out of the way, the carriage passes over it and the cam on the apron retards the steady rest completely out of the way while the carriage continues to the end of the pipe.

On the return of the carriage, this operation is repeated in reverse and the carriage again passes through the middle of the machine without interruption. The entire operation of removing and replacing the two steady rests is completely automatic and does not require any attention whatever. Both steady rests are equipped with rollers that are adjustable to accommodate the change in pipe size.

Due to the fact the pipe coating machine is portable, it can be moved to any jobsite desired for the customer's convenience. In jobs to be done away from electric power, a portable electrical generating set may be made available.

This machine is now in operation at the Honolulu Gas Company. * *

General Petroleum's Unusual Pipe Line in Operation

General Petroleum Corporation's new and unusual San Ardo pipe line has been put into operation, the first tanker load of San Ardo crude oil having been loaded at Estero Bay on July 6.

The tanker loaded more than 80,000 bbl of oil through facilities leased from another company. About 80 per cent of the load was crude oil, the remainder being a light cutter oil that is brought in to be mixed with the heavy, sticky San Ardo crude oil to make it flow, which it will not do in an ordinary pipe line. The cutter oil is delivered to San Ardo through a small pipe line that parallels the larger one.

The new General Petroleum line, built at a cost of more than $2,000,000, employs heat as well as the cutter oil to persuade the oil to flow. The mixture of cutter oil and crude is heated as high as 175 F as it is pumped along the 40-mile pipe line route to the sea.

The line, which makes full exploitation of the estimated 50,000,000 to 100,000,000 bbl of crude oil lying beneath the San Ardo field economical for the first time, is currently delivering about 8000 bbl a day of the crude oil-cutter oil mixture to the Estero Bay terminal. At full capacity it is believed that the line could handle several times this volume.

The San Ardo field is currently producing 2800 bbl a day. Companies producing in the field (which do not include General Petroleum) have indicated publicly their intention to institute extensive drilling programs to increase the field's production.

Materials for the line, both pipe and pumping installations, were obtained by dismantling a 38-year-old idle pipe line in the Mojave Desert. More than 98 per cent of the old pipe was reusable, thanks to special reclamation techniques worked out especially for the project. The reclamation saved more than 2500 tons of scarce pipe and many thousands of dollars.

Products Pipe Lines In Transportation*

In 1950 pipe lines delivered 26 per cent of domestic demand for light products compared with 20 per cent in 1946

JOHN E. BOICE†

In more recent years there has been a significant increase in the use of pipe lines for the transportation of refined products from the refining centers to important marketing areas. Products pipe lines have thoroughly demonstrated this method as the economic way of handling large shipments of liquid products on overland routes to centers of stabilized demand. The result has been consistent growth in such facilities and it is not difficult to envision future distribution of refined products by pipe lines to every sizable inland community.

John E. Boice

Those of us connected with Government are not burdened with the responsibilities of designing or operating pipe lines but we, nevertheless, are vitally interested in their performance. We appreciate the important role that these underground arteries play in the overall transportation field and without them this country would be severely handicapped. Furthermore, we know that operating efficiency depends upon a high load factor, adequate manpower, and sufficient materials for construction and maintenance. The mounting demands for refined oils, together with the resultant increase in refinery runs, assures adequate supply for products pipe lines. On the other hand, PAD is doing its utmost to see that your manpower needs are protected and that essential material requirements are made available.

The product pipe line can well be referred to as the "infant" of the oil industry. The long-distance transportation of refined petroleum products by pipe lines is a relatively new form of transportation. Although oil was discovered in 1859—92 years ago—it was not until some 70 years thereafter that refined products moved to any appreciable extent through pipe lines. Prior to the early thirties, practically all refined products were moved from the refineries to points of consumption by railroad tank car, barge, tanker, or truck. Many of us old-timers will recall, however, that on February 1, 1930, the Tuscarora Oil Company, Ltd., began pumping gasoline from Bayway, New Jersey, westward to Midland, Pennsylvania, a distance of some 370 miles. Incidentally, this line is still functioning but recently required having its "face lifted" to handle greater throughput. There followed shortly thereafter the construction of additional major products pipe lines, including the Phillips and Great Lakes systems. A phenomenal expansion of such pipe lines has taken place the past 20 years. Let me give you a few statistics to substantiate that statement:

According to figures compiled by the U. S. Bureau of Mines, there were only 1400 miles of products pipe lines in 1931. By 1936 the total reached 4600 miles, and by 1941 had increased to 9001 miles. The most recent study showed 20,881 miles at the end of 1949. These figures indicate that the mileage of products pipe lines more than doubled since the beginning of World War II. The oil industry has been constructing products pipe lines in the postwar period at an average rate of more than 1600 miles annually. It is conservatively estimated that there are now approximately 23,000 miles in operation.

If all of the pipe making up existing products lines were laid end-to-end, it would be sufficient to provide about eight parallel lines extending across the United States from the Atlantic to the Pacific coasts. The products pipe lines have greatly shortened the hauls formerly made by tank cars, barges, and trucks. These lines demonstrated their value last February during the railroad switchmen's strike. With thousands of tank cars stranded in yards, the pipe lines continued to operate on an uninterruptible basis, thereby pulling the country through a critical period of threatened fuel shortage.

Now let us review what has been gained by the enlargement that has taken place in the last five years. In 1946, the aggregate domestic demand for gasoline, kerosine, and distillate exceeded one billion dollars, whereas by 1950 corresponding demands rose to more than 1½ billion barrels, an increase of 41 per cent. In 1946, the delivery of light products by pipe lines totaled about 216,000,000 bbl, or 592,000 bbl per day, whereas in 1950 such deliveries rose to 393,000,000 bbl, or 1,077,000 bbl per day, an increase of 82 per cent.

Let us review these figures from another angle. In 1946, the products pipe lines were delivering only 20 per cent of the total domestic demands for light products, whereas in 1950 such deliveries amounted to 26 per cent. This certainly denotes progress and illustrates that the products pipe lines are rapidly approaching the period when they will be the principal mode of transportation for moving light refined products. Deliveries are now exceeding 1,200,000 bbl per day and will reach a higher level this summer. Had the former government-owned "Little Big Inch" line, which you will recall was a 1475-mile, 20-in. line with a carrying capacity of 225,000 bbl per day, not been converted to natural gas service, the mileage of products pipe lines today would be much greater and deliveries substantially higher. You will readily appreciate that it requires many 6, 8, and 10-in. lines to offset the capacity loss of this one giant carrier.

It is noticeable that the products pipe lines are going westward. In recent years lines have been built from Texas into Colorado, Wyoming into Colorado, and from Utah to the state of Washington, with the possibility of being extended to the Puget Sound area. There is also pending a proposal to build a line between Texas and California. Products lines are now operating in 38 states and the District of Columbia, with eight of these states having more than 1000 miles each. The states of Pennsylvania, Texas, and Kansas have more than 2,000 miles each.

By no means is the expansion of products pipe lines dormant. On the contrary, a recent study shows there

*Presented before American Petroleum Institute Conference on Products Pipe Line Technology, Atlanta, Georgia, May 21-23, 1951.

†Petroleum Transportation Engineer, Supply and Transportation Division, Petroleum Administration for Defense.

are 1200 miles now under construction and more than 4500 miles planned to be built in the near future. The completion of such facilities, naturally, is conditioned on the availability of pipe and other materials presently in short supply. In addition, many conversions of existing small-diameter crude oil lines to products service is anticipated.

The immediate demands for line pipe far exceed the ability of the mills to produce. Consequently, the construction of only those lines that are considered most beneficial to the defense effort will receive first call on available supplies. Other lines will necessarily have to be deferred at least until materials become more plentiful. The pipe situation is tight, first, because steel itself is tight and second, because pipe is made largely from plate, and plate seems to be in shorter supply than any of the other mill forms. The oil industry is aware of this situation and is taking appropriate means of helping itself. I could cite many instances where old crude lines no longer essential are being dismantled and the pipe taken up, reconditioned, and shipped elsewhere for re-laying. This results in costly construction work, but certainly expedites the completion of needed projects. May I suggest that you survey your entire system and help yourselves wherever possible by using second-hand materials.

In closing, I would like to make a prediction. With the rapidly increasing demands for liquefied petroleum gas, we may expect to find more and more products pipe lines moving butane and propane through their systems. Some companies are doing this already, while others have the matter under consideration. Pressure tank cars are not being built in sufficient numbers to satisfy the seasonable demands for LP-G. The necessity of moving avgas components will also divert pressure tank cars from LP-G service. The need for more propane for agricultural purposes is rising. During 1950 some 100,000 farm tractors were converted from gasoline to propane fuel. It is expected a similar number will be changed over in 1951. Trucks and buses are consuming large quantities of that fuel. Propane is also being used by manufacturing plants during peak winter periods when natural gas supplies are reduced in order to meet the requirements of household consumers. There are even rumors that a pipe line will be constructed from the Southwest to the Midwest to handle propane exclusively. The growth in the demand for this kind of fuel may result in big transportation business in the future and should be given careful attention by owners of products pipe lines. * * *

Richfield Renames Station for A. M. Kelley

Honoring a former vice president, Richfield Oil Corporation has renamed its Wheeler Ridge pump station the A. M. Kelley station.

Special ceremonies observing the occasion were held at the station, about 21 miles southwest of Bakersfield, with 80 friends and relatives of the late Albert M. Kelley and Richfield officials attending.

A bronze plaque recording Kelley's service as vice president of Richfield in charge of refining, pipe line, and marine transportation departments from March, 1937, to January, 1945, was installed in the station control room. An appropriately inscribed silver tray was presented to Mrs. Kelley and framed photo copies of the bronze plaque were presented to her and to the son, C. E. Kelley, executive assistant in Richfield's manufacturing department.

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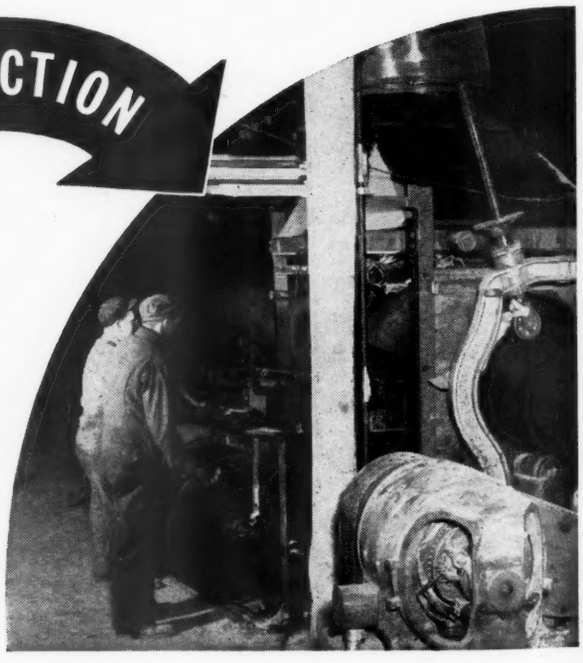

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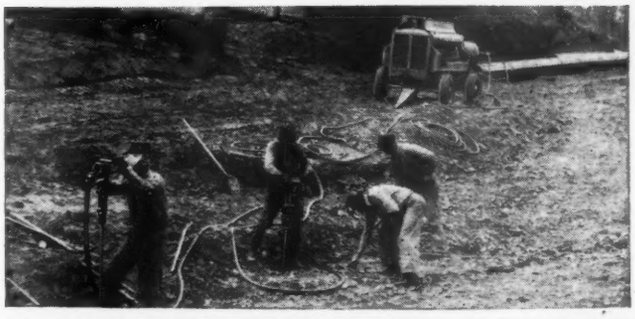

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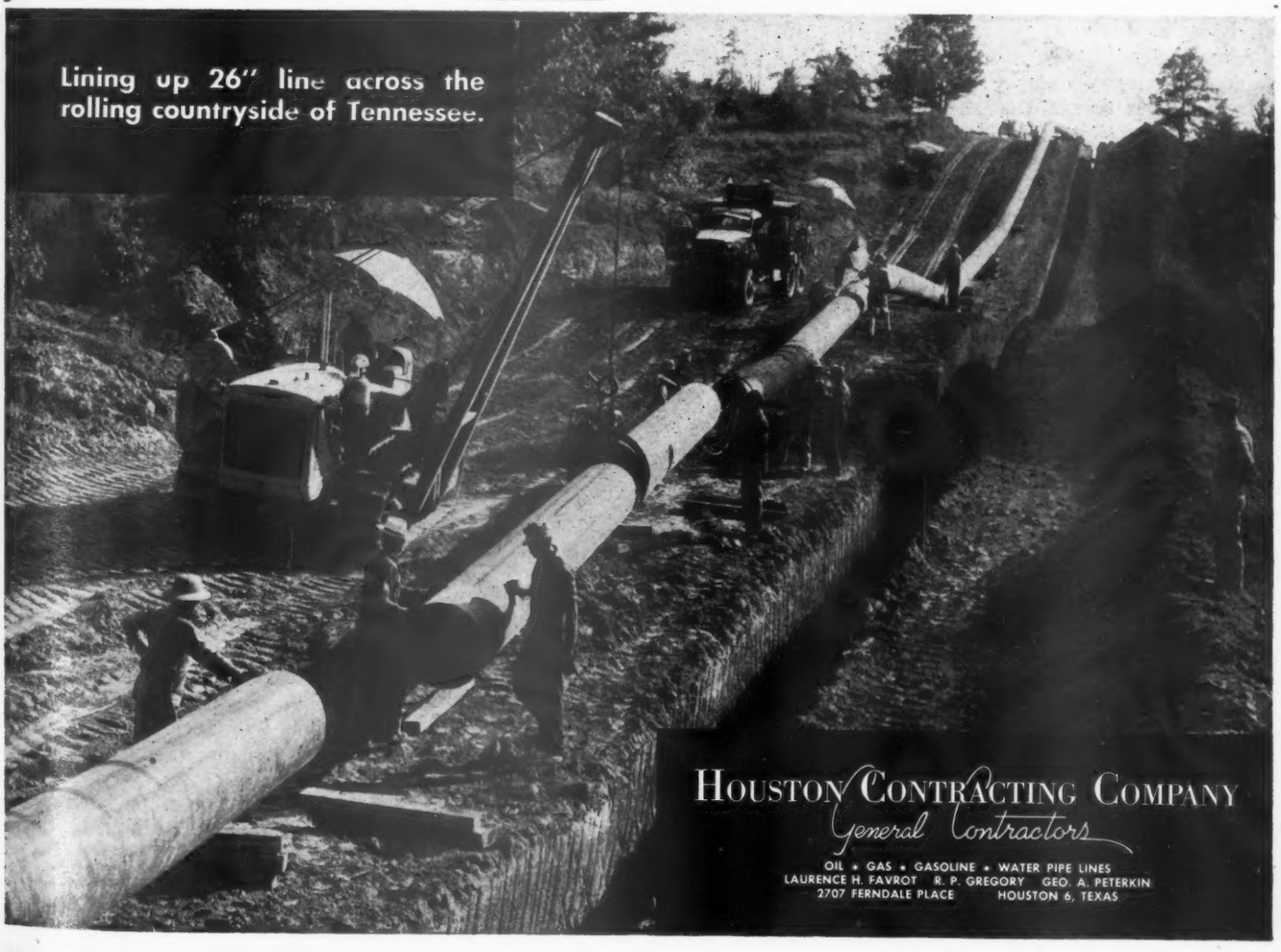
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New Operating Division For Texas Eastern

E. R. Cunningham, vice president of Texas Eastern Transmission Corporation, has announced formation of a new operating division known as Division 5. This division embraces the area from Kosciusko, Mississippi, to the northern boundary of Kentucky, with the division office at Lebanon, Tennessee. "Formation of the new division permits an extensive series of promotions affecting operating personnel," Cunningham said.

"Need for the new division," he added, "developed from Texas Eastern's current $114,300,000 expansion program, largest single project of which provides for a new 30-in. natural gas transmission line from Kosciusko, Mississippi, to Connellsville, Pennsylvania."

Edward J. Kennelly, presently the division manager at Downingtown, Pennsylvania, becomes division manager of Division 5 and William Falleaf, formerly assistant division manager of Division 4 at Baytown, Texas, becomes assistant division manager at Lebanon.

Paul L. Hughen, until now division manager at Baytown, replaces Kennelly as manager of Division 3 at Downingtown.

William C. Britt, former assistant division manager at North Little Rock, Arkansas, transfers to Baytown, Texas, as division manager. Earl Humble moves up from division engineer to assistant division manager at Baytown.

At North Little Rock, Robert S. Cooper, previously division engineer, assumes the duties of assistant division manager.

Trans Mountain Obtains Funds for Further Surveys

Trans Mountain Oil Pipe Line Company has announced that Socony Vacuum Oil Company, Inc., Gulf Oil Corporation, Imperial Oil Limited, and the Bechtel interests have become stockholders of the company and have subscribed equally for an initial capital of $500,000. These funds will be utilized to cover the costs of completing engineering and field surveys on behalf of Trans Mountain for an all-Canadian pipe line route from Alberta to the Vancouver area.

It is estimated that the intensive studies currently being carried on will cost approximately $300,000. On completion of these studies within the next few months, the three oil companies, together with other oil companies who may participate, will determine whether to proceed with the actual construction of the project, which would cost between $60,000,000 and $100,000,000, depending upon the size and capacity of the line.

Trans Mountain Oil Pipe Line Company received its charter from the Canadian Parliament earlier this year.

New Approach Keeps Employees Informed

Northern Natural Gas Company is using an unusual and what should be effective means of seeing that their employees are well versed on facts concerning the company and able to answer questions that the general public may "throw at them." In a recent issue of *Northern Natural News*, employee magazine, a full page is used, in the center of which is a billfold card, the rest of the space on the page containing "copy" calling attention to the card and urging the employee to detach it and place in his billfold. On the card is ready data about the company, handy at all times in case of need. Extra copies of the billfold card are available for anyone interested enough to drop a line to W. J. Quinlan, editor, *Northern Natural News*, Omaha, Nebraska.

Gulf to Construct West Texas Crude Oil Line

Gulf Oil Corporation expects to begin construction immediately of a new crude oil pipe line originating in the northeast part of Upton County, Texas, and connecting with the company's main West Texas pipe line system at Midland, Texas.

The new carrier will be about 42 miles long and 6 in. in diam. It will serve the Spraberry oil producing areas of Upton, Glasscock, Reagan, and Midland counties.

Shell Completes Water Terminal at Colusa

Petroleum products became the most important cargo on the upper Sacramento River with the completion of Shell Oil Company's new water terminal at Colusa.

The terminal will handle nearly 2,500,000 gal of petroleum products each month for redistribution to cities throughout the upper Sacramento Valley and parts of southern Oregon, according to Division Manager Harry Stewart. Shell announced it will transport petroleum products to Colusa from its Martinez refinery on 500,000-gal capacity, tug-pushed barges operated by the River Lines.

The barges will travel to Colusa through a channel that will be maintained at a minimum depth of 6 ft throughout the year by the Army Corps of Engineers. Before Shasta Dam was constructed, the channel was too shallow for navigation during summer months.

At Colusa the fuels will be pumped into storage tanks capable of holding more than 1,000,000 gal of petroleum products and then repumped into tank trucks for final distribution to eventual destinations.

The storage tanks ranging up to 8250-bbl capacity are of latest construction and loading pumps are able to deliver up to 400 gal of gasoline a minute to waiting tank trucks.

Natural Gas Department AGA to Meet in St. Louis

The fall meeting of the Natural Gas Department of the American Gas Association will be held in St. Louis, Missouri, in conjunction with the association's annual convention October 15 to 18. The Natural Gas Department will hold a joint session with the Manufactured Gas Department, as a result of the successful joint session held last year. The meeting will be held one afternoon, with several important papers on problems of management being delivered.

The Natural Gas Department's program committee, appointed by Chairman Bennett in Dallas, consists of E. L. Rawlins, chairman; F. T. Parks, Paul R. Taylor.

Gas Industry to Spend $4.59 Billion for Construction Next Five Years

A year ago it was predicted that gas pipe line and distribution companies would, for the first time, spend more than $1,000,000,000 (billion) for the construction of new facilities in 1950. That prediction has been more than realized, according to the American Gas Association's Bureau of Statistics. The industry expended $1,198,300,000 for new plant and equipment during the year, approximately $130,000,000 in excess of anticipations 12 months ago.

A recently completed survey by the Bureau of Statistics reveals that the gas industry apparently is not satisfied to rest on its laurels. The forecast for the year 1951 indicates expenditures of $1,541,600,000; for 1952, $1,296,400,000; for 1953, $707,500,000; for 1954, $553,800,000; for 1955, $492,800,000. This is a total during the 1951-55 period of $4,592,100,000.

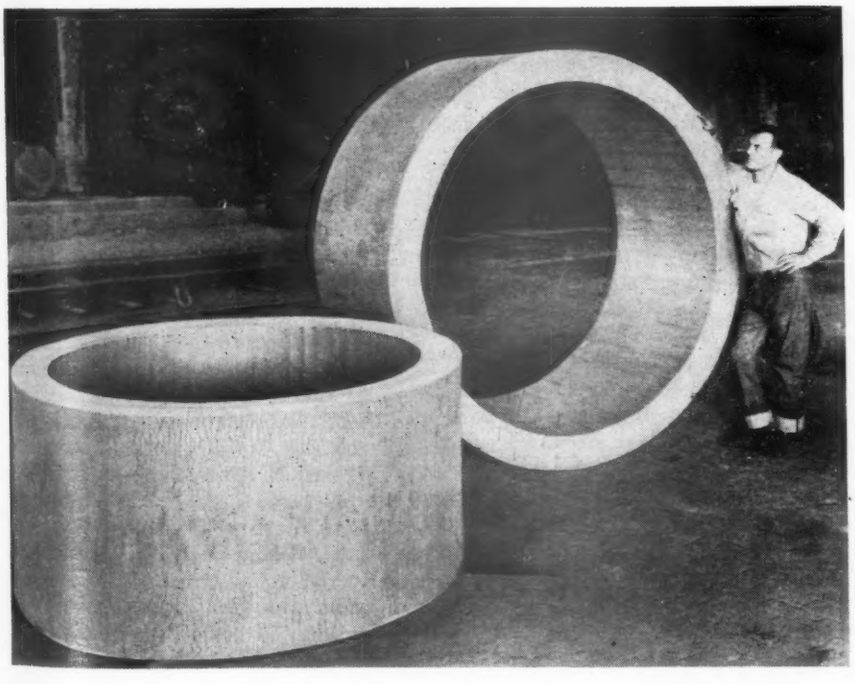
During the last five years, 1946-50, pipe line and distribution companies spent $3,990,000,000 for the purchase and construction of new plant and equipment. In the next five years, 1951-55, it is estimated they will spend $4,590,000,000. Natural gas transmission lines represented the largest single category of expenditures — $2,190,000,000 having been spent during the 1946-50 period. During the next five years, $2,400,000,000 will be spent, it is estimated.

Statistics on natural gas transmission lines, about which we are particularly interested, show that expenditures for 1950 were $713,300,000. During the next five years they will be as follows: 1951, $994,800,000; 1952, $773,000,000; 1953, $295,400,000; 1954, $185,800,000; 1955, $146,800,000. For subsequent years, a substantial decline is indicated in expenditures, as will be noted; however, they may very likely be understated, the report says. Even so, the current estimates for the years 1953 and 1954 are almost double those projected for these years 12 months ago.

For the first time, anticipated expenditures for the development of underground storage facilities are shown as a separate item. These total $92,000,000 for the coming five years, although this amount undoubtedly is an understatement of eventual expenditures, because of the present inability of several of the responding companies to forecast completely their expectations beyond the next two years.

Uncertainties in the present world situation, material supply status, and price trends add to previous difficulties of developing precise forecasts for the more remote years, it is pointed out. The present transmission line estimates are based on projects for which certificate approvals had been granted by the Federal Power Commission as of June 1, 1951, plus allowances for some pending pipe line projects for which the prospects for approval were bright.

All estimates refer to gross expenditures and include outlays for replacements and modernization, although the preponderance of the expenditures will be for additional facilities.



Giant Gear Forgings. Forged, heat-treated, and rough-machined in The National Supply Company's plant at Torrance, California, these ring gears are now in use on speed increaser units at pumping stations along the 1000-mile Mid-Valley Pipeline. These rings are of SAE 4340 forged alloy steel, 83 in. OD by 76 in. ID by 21 in. face, the rough weight each being 15,255 lb. They are the outer rims of the bull gear for each of the eight 1700-hp speed increaser units along the pipe line. Pacific-Western Gear Company completed the manufacture of the gears.

AGA Officers and Directors Nominated

Gas industry executives of 32 companies in 19 states and Canada have been nominated as officers and directors of the American Gas Association. This list of nominees, which includes representatives of manufactured, mixed, and natural gas companies as well as manufacturer and holding companies, will be placed before the membership for election at the 1951 AGA convention in St. Louis, October 15-17. Additional nominations for election may be placed by any 50 members of the association.

The general nominating committee, with Hudson W. Reed, president, The Philadelphia Gas Works Company, as chairman, recommended candidates for election as president, first and second vice-presidents, and treasurer.

In addition to the slate of officers, 15 gas industry officials have been nominated to serve as directors of AGA for a two-year term. Reed's general committee has also submitted the recommendations of nominating committees of five AGA sections and two general committees. If elected at the October convention, the nominees for chairmen of these sections and committees automatically will become section vice presidents of the association and members of the executive board. Five other gas officials were nominated as vice chairmen of these sections and general committees.

The following list of nominations will be placed before the AGA membership for election:

For president—George F. Mitchell,

president, The Peoples Gas Light and Coke Company, Chicago, Illinois.

For first vice president—Charles E. Bennett, president, The Manufacturers Light and Heat Company, Pittsburgh, Pennsylvania.

For second vice president—Earl H. Eacker, president, Boston Consolidated Gas Company, Boston, Mass.

For treasurer—Edward F. Barrett*, president, Long Island Lighting Company, Mineola, New York.

For director—Two-year term expiring October, 1953—B. C. Adams*, president, The Gas Service Company, Kansas City, Missouri; M. A. Abernathy, vice president, United Gas Pipe Line Company, Shreveport, Louisiana; L. L. Baxter, president, Arkansas Western Gas Company, Fayetteville, Arkansas; Ralph L. Fletcher, president, Providence Gas Company, Providence, Rhode Island; J. A. Fry, president, Detroit-Michigan Stove Company, Detroit, Michigan; R. M. Heskett, president, Montana-Dakota Utilities Company, Minneapolis, Minnesota; E. G. Lawson, president, Pacific Public Service Company, San Francisco, California.

Also nominated as director for two-year terms were: J. F. Merriam*, president, Northern Natural Gas Company, Omaha, Nebraska; Dean H. Mitchell*, president, Northern Indiana Public Service Company, Hammond, Indiana; J. French Robinson*, president, Consolidated Natural Gas Company, New York, New York; Louis Ruthenburg, chairman of the board, Servel, Inc., Evansville, Indiana; Earl Smith, president, South Jersey Gas Company, Atlantic City, New Jersey; Paul R. Taylor*, vice president, Stone and Webster Service Corporation, New York, New York; Thomas Weir*, general manager, Union Gas Company of Canada, Ltd., Chatham, Ontario, Canada; and J. Theodore Wolfe, executive vice president, Consolidated Gas Electric Light and Power Company of Baltimore.

Section and general committee nominations were as follows:

Accounting Section: For chairman—Ralph F. McGlone, Cleveland commercial manager, The East Ohio Gas Company, Cleveland, Ohio; for vice chairman—Bernard S. Rodey, Jr., assistant secretary, Consolidated Edison Company of New York, Incorporated, New York, New York.

Industrial and Commercial Gas Section: For chairman—Ronald A. Malony, executive vice president, The Bridgeport Gas Light Company, Bridgeport, Connecticut; for vice chairman—Terry Hart, general sales manager, Nashville Gas and Heating Company, Nashville, Tennessee.

Residential Gas Section; For chairman—William J. Schmidt, assistant vice president and general sales manager, Long Island Lighting Company, Mineola, New York; for vice chairman—Raymond J. Vandagriff, general sales manager, Laclede Gas Company, St. Louis, Missouri.

Operating Section: For chairman—H. Bruce Andersen, vice president in charge of distribution, The Philadelphia Gas Works Company, Philadelphia, Pennsylvania; for vice chairman—Channing W. Wilson, research chemist, Consolidated Gas Electric Light and Power Company of Baltimore, Baltimore, Maryland.

Manufacturers Section: For chairman—Gordon LeFebvre, president, The Cooper-Bessemer Corporation, Mount Vernon, Ohio.

Laboratories Managing Committee: For chairman——Arthur F. Bridge*, president and general manager, Southern Counties Gas Company, Los Angeles, California; for vice chairman—Charles E. Bennett, The Manufacturers Light and Heat Company, Pittsburgh, Pennsylvania.

Publicity and Advertising Committee: For chairman—C. J. Allen*, vice president (retired), The Connecticut Light and Power Company, Waterbury, Connecticut; for vice chairman—Harold E. Eckes, director of advertising and publicity, The East Ohio Gas Company, Cleveland, Ohio.

*Renominated.

Proposes to Develop Underground Storage

Cities Service Gas Company, of Oklahoma City, Oklahoma, has filed an application with the Federal Power Commission proposing to develop two depleted gas fields in Kansas for the underground storage of natural gas.

Cities Service is planning to acquire the Colony field in Anderson County and the McLouth field in Leavenworth and Jefferson counties, and to construct facilities necessary to utilize the fields for gas storage. The company contemplates that it will be able to procure gas storage leases on a substantial portion of each field, but said that in event of failure to do so, storage rights will be procured by condemnation proceedings.

The company also is seeking authorization to replace approximately 10 miles of double 16-in. lines with a single 26-in. line between its Welda and Ottawa compressor stations in Franklin County, Kansas.

Cities Service said the facilities are expected to increase its wintertime maximum daily available delivery supply by approximately 120,000,000 cu ft of gas.

Estimated total cost of the facilities is $1,035,000 for the Colony field; $2,017,627 for McLouth field, and $419,000 net for replacement costs.

Frank W. Thompson

F. W. Thompson Elevated By Natural Gas Group

Election of Frank W. Thompson vice president of American Natural Gas Service Company, Michigan Consolidated Gas Company, and Michigan Wisconsin Pipe Line Company is announced by Henry Fink, president. He will have charge of all rate matters for the three companies.

Thompson was graduated from the California Institute of Technology in 1929 with the degree of bachelor of science in mechanical engineering. He was employed at various times by Standard Oil of California, General Petroleum Company, and the Los Angeles Gas and Electric Corporation.

Thompson is author of a number of engineering articles and wrote the portion of the Federal Power Commission's report on the natural gas investigation relating to natural gas reserves and the practices and problems of producing, gathering, and processing natural gas.

He has been associated with the American Natural Gas Service Company since February, 1950.

Texas Eastern Awards Two Construction Contracts

Texas Eastern Transmission Corporation has awarded to The Eastern Pipe Line Contractors, of Dallas, Texas, a contract for construction of 76 miles of 30-in. pipe line from the Tennessee River to a point near Columbia, Tennessee.

H. B. Zachry Company, of San Antonio, Texas, has been awarded a contract for construction of 74 miles of 30-in. pipe line from a point near Columbia, Tennessee, to the Cumberland River in northern Tennessee.

Hearing Continued

Hearing on application of Southwestern Virginia Gas Transmission Company, of Martinsville, Virginia, was continued by FPC from July 23 to August 3 in Washington, D. C.

The continuance was requested by the company, whose application involves proposed natural gas service in the Martinsville area.

API Publishes Accident Manual on Tanks

A new accident prevention manual dealing with the cleaning of mobile tanks used for transporting flammable liquids has been published by the American Petroleum Institute.

Prepared by the Institute's Safety and Fire Protection Services, the new manual was designed specifically for tank vehicles. Other manuals will be published later applying to skid tanks and tank cars.

The purpose of the new publication is to provide information on how to clean safely, prior to repair, any equipment that is used in the transportation of flammable liquids.

Attention is called to the measures that should be taken to protect personnel against harmful vapor concentrations, and to avoid ignition of flammable vapors that may be present during certain phases of mobile tank-vehicle cleaning operations.

The manual is No. 13 in the series of accident prevention booklets issued by the API. Its title is "Cleaning Mobile Tanks used for Transportation of Flammable Liquids; Section A—Tank Vehicles." The manual is priced at 25 cents, with discounts for bulk orders. Copies may be obtained by writing to the American Petroleum Institute, 50 West 50th Street, New York 20, New York.

AGA Issues Combustion Studies Bulletins

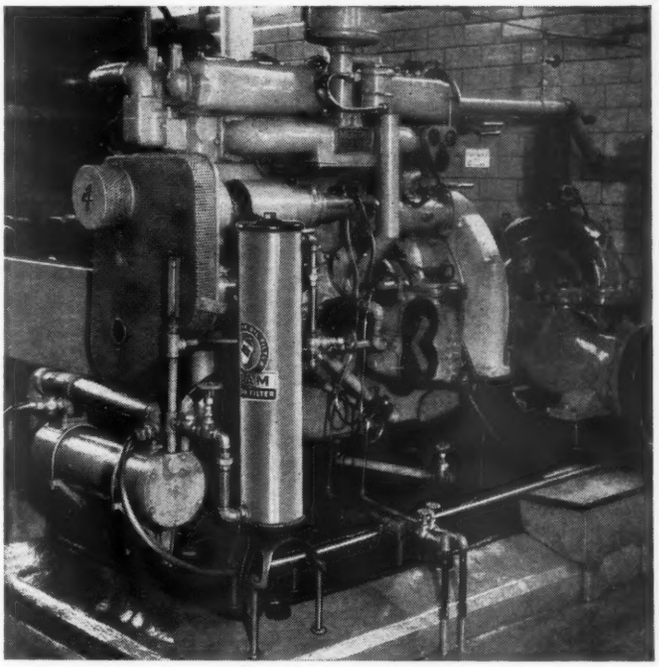
The committee on industrial and commercial gas research of the American Gas Association has issued two reports, which the committee believes will provide the foundation for new approaches and new thinking on methods of burning industrial gas to meet the new conditions required by the nation's accelerated production processes. The bulletins are reports on research projects being carried out under the AGA Promotion, Advertising and Research (PAR) Plan.

"Advanced Studies in the Combustion of Industrial Gases —Part II" is the second report issued on methods of increasing the number of Btu's from industrial gas in a given space and in a given time. Part I of this report presented some experimental views of the application of the principle of detonation to the burning of industrial gas. Part II of the report by Dr. John J. Turin, University of Toledo and Jack Huebler, Surface Combustion Corporation, Toledo, further attempts to develop theories of detonation that would apply to industrial gas when fed at continuous rates. The report records observations and experimental reactions in relation to these theories.

Another PAR Plan exploration into new ways of burning industrial gas in the future is recorded in the report "Gas-Air-Oxygen Combustion Studies." With the advent of lower cost oxygen of commercial purity, and with the prospect of still lower costs, the use of oxygenated air for many high temperature industrial heating operations becomes a distinct possibility. This study investigates technical and practical phases of the problem such as combustion characteristics, temperatures attainable, burning velocities, combustion space requirements and a large number of other details. This report forms the basis for designing and successfully operating commercial processes utilizing various percentages of oxygen mixed with combustion air.

Flood Damages Great Lakes System

Harry Moreland, president of Great Lakes Pipe Line Company, estimates it may require 60 days to repair station and terminal damage at Kansas City resulting from the recent flood, greatest in Midwest history. Acceptance of gasoline shipments had to be curtailed for a time. To relieve the situation until permanent repairs can be made, temporary pumping equipment has been installed at Leavenworth, Kansas, and Paradise, Missouri, consisting of converted Allison aircraft engines as power.



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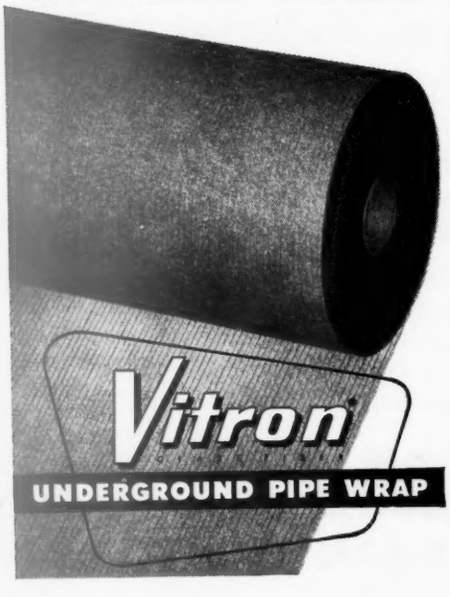


New Requirements in 1951 Piping Code

New and important safety requirements for the various piping systems throughout the nation that carry liquids or gases at high pressure are contained in the 1951 edition of the American Standard Code for Pressure Piping that has just been published.

The new edition of the code was prepared by a widely representative committee, sponsored by the American Society of Mechanical Engineers under American Standards Association procedures. It establishes minimum safety requirements for various piping systems ranging from tiny systems operating delicate instruments to the huge pipe lines carrying gas and oil for thousands of miles across the country. The original code was published in 1935 and also was adopted as an American Standard.

Standardization, the official magazine of the American Standards Association, states the revised standard is intended as a guide in selecting materials that will safely withstand the pressures and temperatures under which various piping systems are operated, and in testing elements that make up a piping system as well as the completed system itself.

"In 1942 when the edition preceding the 1951 edition of the Code for Pressure Piping was published," the magazine points out, "the largest heavy-duty cross-country pipe lines were 20 to 24 in. in diam. Since that time the Federal Power Commission has issued certificates for nearly 34,000 miles of new long distance lines extending from southwestern producing fields to eastern consuming areas. Several of the recently installed heavy-duty lines were 30 in. in diam, and a 34-in. line is now under construction.

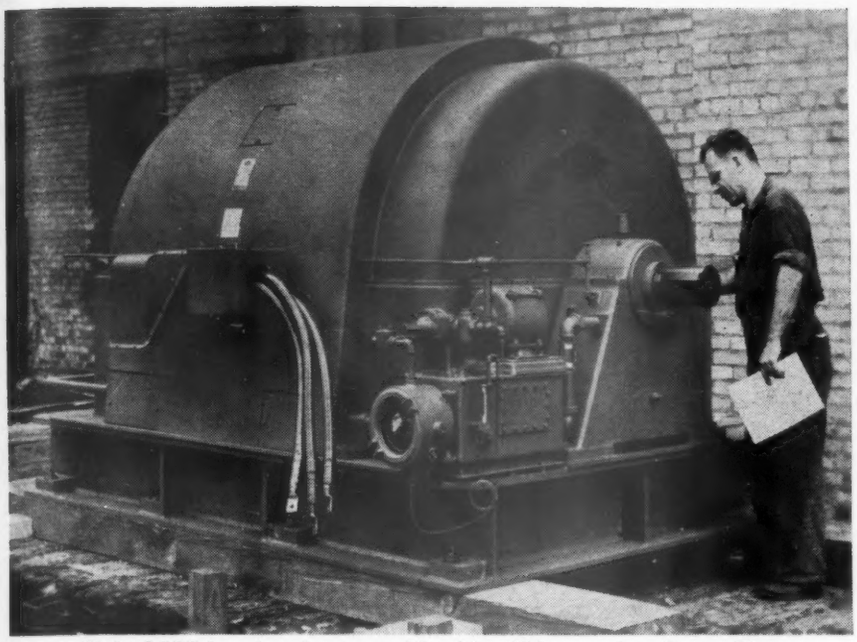
"Steady improvement in materials has made it possible to increase pipe diameters for a given wall thickness without a corresponding decrease in gas pressures. Not only is the greatly enlarged volume of gas transported an economically significant item, but it is estimated that the now more efficient use of steel makes it possible to save as much as 100,000 tons of steel on one cross-country pipe line alone.

"The Code for Pressure Piping has played an important role in the extension of gas as an economical fuel to large population centers," *Standardization* says.

"An experience in Michigan in 1949 offers an example. Country property owners protested the installation of a gas pipe line on the ground that it would be unsafe. An investigation by the State Public Utility Commission, conducted under the direction of members of the University of Michigan faculty, put the pipe line through severe tests and proved to the satisfaction of the commission that pipe meeting the requirements of the code would be safe. The Michigan commission is only one of the regulatory groups that has ordered that gas pipe lines follow the requirements of the Code for Pressure Piping."

The gas industry is especially interested in the code because it provides realistic minimum construction requirements and offers the basis for a program of self-regulation in matters of safety. Requirements outlined in the section of the code covering gas and air piping not only apply to transcontinental gas transportation systems but to distribution systems in cities, and to gas and air piping systems in compressing stations and gas manufacturing plants as well.

Development of new specifications for materials has been recognized by eliminating some of those formerly in effect and substituting new American Society for Testing Materials and American Petroleum Institute specifications now in general use. New requirements have been included for pipe (except cast iron pipe) in gas and air compressing station piping systems. These will result in thicker pipe walls, other factors being equal, than previously required in compressing station piping.



Eight 3000-hp electric motors like this will be used on Texas Pipe Line Company crude oil line.

Big Electric Motors for Basin Pipe Line System

The largest electric motors and pumps ever built for oil pipe line pumping service are now being installed by The Texas Pipe Line Company, Houston, Texas, on what is known as the Basin Pipe Line System, for an expansion of the 515-mile, New Mexico to Oklahoma crude oil line.

Eight 3000-hp, 1780-rpm induction motors will drive huge centrifugal pumps in four stations of the Jal, New Mexico, to Cushing, Oklahoma, section of the line. These eight motors, and seven similar 1250-hp units will add 100,000 bbl a day to the pumping capacity of the pipe line system, which delivers crude oil from West Texas and eastern New Mexico to connecting pipe line carriers at Cushing, Oklahoma, for movement into the Chicago-Great Lakes area.

These 3000-hp motors use pressure-lubricated bearings, and are fully enclosed for ventilation from a filtered fresh air source to minimize fire hazard. Despite their great horsepower, the motors will be started across-the-line at full voltage, and they are designed for specially low starting current to minimize the disturbance to the power systems.

The accompanying picture shows one of the motors ready for shipment from the Electric Machinery Manufacturing Company factory in Minneapolis, Minnesota.

Rules Amended on Gas Export - Import Filing

The Federal Power Commission has issued an order amending its regulations under the Natural Gas Act relating to requirements for filing applications for authorization to export or import natural gas.

The amendment is designed to eliminate the requirement previously contained in the commission's rules that the owner of a source of supply of natural gas who proposes to export or import natural gas or who has entered or proposes to enter into a contract to supply natural gas to be exported or imported shall be a necessary party to an application for the authorization required under the Natural Gas Act. It is effective immediately.

Preliminary Plans Made For NACE 1952 Meeting

Preliminary plans for the 1952 annual conference of the National Association of Corrosion Engineers were made at a Chicago, Illinois meeting of the association's executive committee. The conference, to be held at Galveston, Texas, March 10-14, 1952, will be the first held in the Southwest since 1944. Exhibits and meetings will be held on the Galveston Pleasure Pier, while the Buccaneer Hotel will be convention headquarters hotel.

Eight technical symposia, a general corrosion session, and two round table or panel discussion sessions are scheduled for the technical program. Technical committee meetings will be held on Monday, March 10, preceding the formal opening of the conference and also during the conference week.

Registration facilities will be available at the Buccaneer and at the Galvez hotels beginning March 10. There will be no pre-registration. The annual association general business meeting will be held Tuesday, March 11, from 11 a.m. to 12:30 p.m.

C. T. Kallina Heads Gas Certificates Division FPC

The Federal Power Commission announces the appointment of Carl T. Kallina as chief of its division of gas certificates to succeed Loring E. Heckman, resigned. Kallina has been acting chief of the division.

Kallina served as head of the engineering analysis section of the gas certificates division before he was named acting chief of the division.

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PIPE LINE PROJECTS

New Pipe Line Outlet For West Central Texas

Service Pipe Line Company, Tulsa, Oklahoma, has awarded contracts to lay a 123-mile, 10-in. pipe line from Haskell County to Bowie, Texas, that will provide a new outlet for West Central Texas oil production, F. M. Willenburg, division manager, Fort Worth, Texas, announces.

Smith Contracting Corporation, Fort Worth, will construct that part of the line from Service Pipe Line's Jud station in Haskell County to the west bank of the Salt Fork Brazos River, and O. R. Burden Construction Corporation, Tulsa and Wichita Falls, will construct the river crossing and the line eastward to Bowie.

J. L. Burke, Tulsa, president of Service Pipe Line, last April announced plans for the Jud-Bowie line. When completed next fall, it will serve new oil development, and will traverse an area where active exploration is under way.

The system will connect production in the Old Glory, Kiowa Peak, and North Aspermont fields of Stonewall County, South Haskell field of Haskell County, and North Knox City field of Knox County.

Willenburg said the entire Jud-Bowie line will be constructed of reconditioned pipe from other parts of the Service Pipe Line system. Most of the pipe is being taken from the ground in Illinois, Nebraska, Missouri, and Texas, and will be cleaned and reconditioned in yards at Haskell and Henrietta.

He said that recently constructed parallel lines of large diameter were designed with enough capacity to permit removal of loops of smaller pipe for re-use elsewhere.

At Bowie the 10-in. line joins Service's north-south trunk system that transports crude oil to refinery centers.

Amere Proposes Addition To West Virginia System

Amere Gas Utilities Company, of Charleston, West Virginia, has asked the Federal Power Commission for authority to construct approximately 33.6 miles of pipe line in West Virginia to increase the capacity of its system to supply the natural gas requirements of present customers.

The company plans to build about 2 miles of line in Wyoming County to reinforce the gas supply to Mullens, West Virginia; to construct approximately 16.5 miles of line in Mercer County to supply additional requirements of Princeton and Athens, West Virginia, and to supply gas at wholesale to Bluefield Gas Company; and to build approximately 15.1 miles of line in Raleigh and Mercer counties to transport gas from Atlantic Seaboard Corporation's Flat Top compressor station to Amere's distribution operations in Beckley, West Virginia, during winter months.

Construction and Retirements Asked

Three subsidiaries of the Columbia Gas System, Inc., have filed an application with the Federal Power Commission in connection with the proposed construction and retirement of natural gas transmission facilities on their systems in Pennsylvania, West Virginia, Maryland, and New York.

The companies are The Manufacturers Light and Heat Company, Cumberland and Allegheny Gas Company, and Home Gas Company, all of Pittsburgh, Pennsylvania. Net cost of the entire project is $1,853,063.

The companies said the project would improve and increase the deliverability of their transmission systems to help assure continuous service to existing customers and to provide for normal growth within the territory served by them. No new markets would be served.

Manufacturers is proposing to construct a total of approximately 26 miles of line; to retire about 18 miles of line; to convert about 3 miles of transmission line into a medium pressure distribution line; and to retire a 125-hp compressor station. The facilities to be constructed and retired are in Fayette, Allegheny, Beaver, Somerset, Adams, Franklin and Westmoreland counties, Pennsylvania, and Hancock County, West Virginia.

Cumberland is seeking authorization to build about 13 miles of line, and to retire approximately the same amount, in Preston and Barbour counties, West Virginia, and Allegany County, Maryland.

Home asked for authority to construct approximately 16 miles of line, paralleling an existing line, in Steuben and Chemung counties, New York.

Mid-Valley Announces Plans for Expanded System

Mid-Valley Pipe Line Company has announced plans to step up capacity on its 1000-mile crude oil line from East Texas to Ohio to meet increasing defense and civilian requirements for petroleum products in Ohio and adjacent area.

Construction of six new booster pump stations, together with additional tankage, will increase from 155,000 bbl to 235,000 bbl per day the capacity of the 565-mile section of 22-in. line between Mayersville, Mississippi, and Hebron, Kentucky, with proportional increases in the sections from Longview to Mayersville and from Hebron to Lima, Ohio.

The new booster stations will be at Stevenson, Louisiana; Minter City, Mississippi; Hornsby, Tennessee; Elkton and Simpsonville, Kentucky, and at Pyrmont, Ohio.

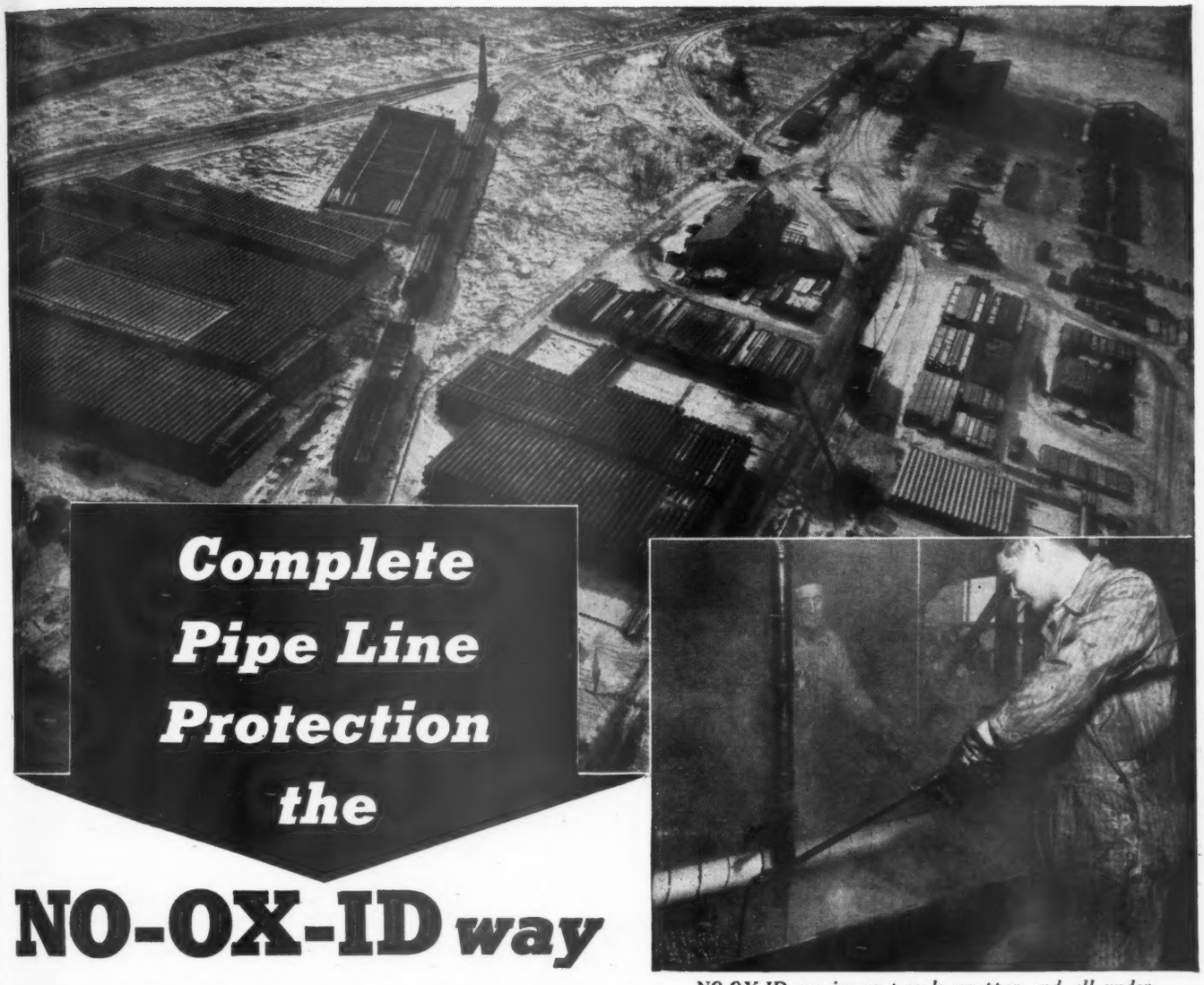
One additional pump unit (either diesel or electric motor) is also to be installed in each of the existing main trunk line stations. A microwave communications facility will be installed at each new booster station.

"Increased refinery demands for Ohio and adjacent areas have made it necessary to include this new construction before the line is fully completed," E. F. Morrill, president of Mid-Valley, said.

Cost of the new installations will be from 8 to 9 million dollars. Completion is expected early in 1952, provided satisfactory delivery can be obtained on materials on order.

Expansion of the capacity of the Mid-Valley line, a common carrier, is part of an overall program to make full use of available new supplies of crude oil from West Texas.

The Mid-Valley line will connect with the projected "big inch" crude line from West Texas through a 20-in. spur from Wortham to Longview in East Texas, the southern terminal of the Mid-Valley line. Sun Oil Company and The Standard Oil Company (Ohio), joint owners of Mid-Valley, are also participants with Gulf Oil Corporation, Cities Service, and Pure Oil Company in a new pipe line that forms a link between West Texas oil fields and pipe line and port facilities in the eastern part of the state. It is expected that construction of this line will begin early in 1952 .



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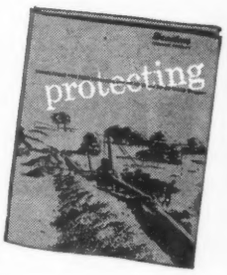

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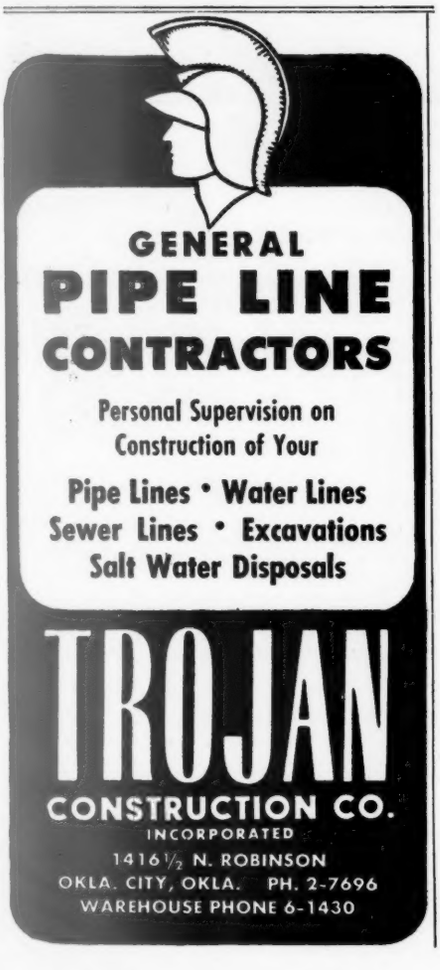
Facilities for Importing Canadian Gas Asked

The Montana Power Company, of Butte, Montana, has filed an application with the Federal Power Commission proposing the construction of pipe line facilities that would be used to import natural gas from fields in Alberta, Canada, into Montana.

The company plans to import the gas from fields in the Pakowki Lake area in southeastern Alberta. The application says that the most recent estimate of the gas reserves in these fields—Pendant d'Oreille, Manyberries, Smith Coulee, and Black Butte—is 488.5 billion cu ft of gas in place, 434.2 billion cu ft recoverable, and 406 billion cu ft net gas marketable. The gas is to be produced and transmitted in Canada by two newly formed subsidaries of Montana Power.

The facilities to be used in the proposed importation of natural gas include about 18 miles of 16-in. line extending from the Pakowki Lake area to a point on the Canada-Montana border, and approximately 52 miles of 16-in. line from that point to a connection with Montana Power's existing system near Cut Bank, Montana. The 18 miles of line would be owned and operated by one of the new subsidiaries of Montana Power.



Short Line Proposed In New York State

Rockland Light and Power Company, of Nyack, New York, has applied to the Federal Power Commission for authority to build 22 miles of transmission line between Orangetown and Tomkins Cove, New York, to transport natural gas purchased from Transcontinental Gas Pipe Line Corporation of Houston, Texas, to its eastern division.

The company is seeking an order from the commission directing Transcontinental to connect and supply the 22-mile line with natural gas from Transcontinental's system at Orangetown.

The proposed line, estimated to cost $753,315, would have a daily capacity of 11,000,000 cu ft.

P G & E Proposal Temporarily Authorized

The Federal Power Commission has granted a temporary certificate to Pacific Gas and Electric Company, of San Francisco, California, for the construction and operation of a proposed 44-mile natural gas pipe line in Monterey County, California.

The line, to be of 8⅝-in. diam pipe, will extend from a junction with an existing line, south of Salinas, through Chualar, Gonzales, Soledad, and Greenfield, to King City. Estimated cost of the project is $678,600.

PG&E now distributes propane-air gas in King City and plans to substitute natural gas upon completion of the proposed new line. The company also intends to build distribution systems in Chualar, Gonzales, Soledad, and Greenfield to be served by the proposed line. The company will serve individual customers along the route of the line.

Northern Natural Given Temporary Authorization

The Federal Power Commission has granted temporary authorization to Northern Natural Gas Company, of Omaha, Nebraska, to construct pipe line facilities that will increase the capacity of its natural gas transmission system north of Kansas by 50,000,000 cu ft per day, to a total of 650,000,000 cu ft.

The commission said it was acting to enable the company to meet emergency 1951-52 winter peaks, and that the authorization is at the sole risk of Northern without prejudice to final commission action. One of the important questions is whether Northern has sufficient quantities of gas to meet future requirements. The commission said a hearing on Northern's original application will begin September 17 in accordance with an order to be issued subsequently.

The 50,000,000 cu ft increase is part of a larger expansion program in which Northern is proposing to construct facilities to bring the daily total capacity of its system north of Kansas up to 825,000,000 cu ft.

The entire construction program, including the facilities authorized by the temporary certificate, is estimated to cost $33,095,000, and consists of a total of 221.8 miles of pipe line additions in Texas, Oklahoma, Kansas, Nebraska, and Minnesota, and compressor additions totaling 84,000 hp in Texas, Kansas, Nebraska, and Iowa.

The facilities authorized by the temporary certificate include 79.5 miles of pipe lines and 27,200 hp in compressor additions.

Consolidated Hearing Set for August 13

The Federal Power Commission has scheduled a consolidated hearing to begin August 13 in Washington, D. C., on three applications involving natural gas service in the west and southwest.

The applications are those of El Paso Natural Gas Company, of El Paso, Texas, and Nevada Natural Gas Pipe Line Company, of Las Vegas, Nevada, and involve proposed service in California, Nevada, Arizona, New Mexico, and Texas.

El Paso, in one application, is seeking authority to build facilities that would be used to make available an additional 100,000,000 cu ft of gas daily to present customers on its system in Arizona, New Mexico, and Texas. Estimated cost of this construction program is $23,250,000.

The other El Paso application includes a construction program, estimated to cost $1,038,404, to increase the capacity of El Paso's facilities to serve the Phoenix, Arizona, area by 67,000,000 cu ft a day, making a total capacity of approximately 143,000,000 cu ft daily. The commission last November granted a temporary certificate to El Paso for these facilities.

Nevada Natural Gas Pipe Line Company wants permission to build a 114-mile pipe line for the transportation of natural gas for resale to distributing companies in Needles, California, and Boulder City and Las Vegas, Nevada. The proposed line, estimated to cost $2,331,350, would extend from a point near Topock, Arizona, to Las Vegas. The company is seeking a supply of natural gas from El Paso.

Phillips Announces 500-Mile Products Line

Philips Petroleum Company has announced plans for the immediate construction of a major expansion of its products pipe line from Borger, Texas, to East Chicago, Indiana, which will alleviate the present shortage of propane in the Chicago and Great Lakes area and also meet anticipated future demands.

K. S. Adams, board chairman, and Paul Endacott, president, stated that this expansion program will require the laying of 500 miles of pipe between Borger and East Chicago. This will increase the capacity of this line by 30,000 bbl a day.

Petroleum Administration for Defense has issued priorities to obtain delivery of pipe in the third quarter of this year. This will permit completion of the line prior to the high consumption of propane during the coming winter months.

Right-of-way for the pipe line has been purchased and delivery of steel has begun. The laying of pipe will begin shortly.

With large underground storage facilities near Borger, Kansas City, and Chicago, Phillips will be in a position to store summer surpluses of propane and other liquefied petroleum gas and have them available near large consuming centers to meet the heavy winter demands.

With a minimum use of critical materials Phillips can substantially increase the delivery of propane through this pipe line when required, it is stated.

444-Mile Products Line Planned for Canada

Ditching machines are beginning to web Ontario with pipe lines.

One of the biggest developments in this underground transportation move was the announcement in Toronto that plans have been completed for a petroleum products pipe line connecting Montreal with Ottawa, Toronto and Hamilton.

A. N. Horne, president of the new Trans-Northern Pipe Line Company, and formerly vice president and general manager of the Trans-Arabian Pipe Line Company, said he hoped construction of the line would start as soon as authorization from the Board of Transport Commissioners had been received. "But," he cautioned, "it depends on the availability of steel."

The British American Oil Company, Ltd., the Shell Oil Company of Canada Ltd., and McColl-Frontenac Oil Company, Ltd. are participating in the venture. The main 10-in. line, which is to be 400 miles in length, will traverse the north shore of the St. Lawrence River and Lake Ontario. It will have terminals at Cornwall, Prescott, Brockville, Kingston, Belleville, Port Hope, Toronto, Clarkson, and Hamilton. A 6-in., 44-mile line will serve Ottawa from a junction in the vicinity of Cornwall.

Having a designed initial capacity of 40,000 bbl a day, the pipe line will transport finished products from the three participating companies' refineries at Montreal East. Majority of crude oil purchased to feed these refineries is transported to Montreal by pipe line from Portland, Maine, where the ocean tankers unload.

Horne, internationally-recognized pipe line authority, said the proposed inter-city line will require less steel than it would take to expand tanker fleets and marine storage bases to serve the fast-expanding market for petroleum products in Canada.

"Apart from the fact the new pipe line would conserve considerable steel now needed for defense purposes," Horne went on, "it would be of inestimable value if by any chance a third world conflict is precipitated."

He also made it plain that even when the pipe line is completed, the demand for petroleum products would make it necessary to utilize existing tanker fleets to the fullest possible extent.

Columbia Subsidiaries' Application Expedited

The Federal Power Commission has acted to speed final decision on applications of three subsidiaries of The Columbia Gas System, Inc., which are proposing the construction of natural gas transmission facilities in Kentucky, Ohio, and West Virginia.

Acting on a motion by three companies, the commission has ordered the immediate decision procedure omitted, which means that the case will be decided directly by the FPC without the filing of an intermediate decision by the presiding examiner.

The proceedings involve two applications by Central Kentucky. The first application is for authority to build about 13 miles of line to carry additional gas to customers in the Cincinnati, Ohio, area, and the second application proposes the construction of 18.6 miles of line to supply additional gas in the southern division.

Ohio Fuel has asked the FPC for authority to build about 61 miles of line in northern and southwestern Ohio to help meet increased demands and future growth in the Sandusky, Elyria, and Dayton market areas. Atlantic Seaboard's application is for authorization to construct a 3250-hp compressor station in Randolph County, West Virginia, on its Cobb (W. Va.)-Rockville (Md.) line.

New 24-In. Line to Connect West Texas With Houston Area

Plans are revealed for construction of a new large-diameter crude oil pipe line to provide an additional link between the nation's largest oil producing area and the greatest refining area. Known as the Rancho Pipe Line system, the new 24-in. line will extend from McCamey, in the Permian Basin of West Texas, to Houston and Texas City, a distance of 477 miles.

With an initial delivery capacity of about 209,000 bbl of oil daily, the Rancho line will further insure that the petroleum industry can meet the extraordinary demands of the defense program for vital oil products. Completion is scheduled late in 1952 at an estimated cost of $35,000,000.

A multiple-ownership project, with six companies participating, the line will be designed, constructed, and operated by Shell Pipe Line Corporation. Other participants are Sinclair Pipe Line Company, Pan American Pipe Line Company, Phillips Pipe Line Company, Nantucket Pipe Line Company (a wholly owned subsidiary of Eastern States Petroleum Corporation, Inc.), and Tidewater Pipe Line Company (a wholly owned subsidiary of Crown Central Petroleum Corporation).

The Rancho line will originate at McCamey, Texas, and run via El Dorado, LaGrange, and Gena into Pasadena, Harrisburg and Deer Park. Plans call for receipt of oil from owners, connecting lines at McCamey, El Dorado, and La Grange. At Genoa, the Rancho will connect to a line terminating at Texas City, and between Harrisburg and Deer Park it will connect with the refineries or terminals of Eastern States Petroleum, Sinclair Refining, Phillips Petroleum, Crown Central Petroleum, and Shell Oil Corporation.

Three pump stations will be built initially near McCamey, El Dorado, and LaGrange, but eventually this summer will be increased to eight, making it possible to increase the line's capacity to 315,000 bbl a day. Pump stations will be electrically powered and each will contain three 2000-hp and one 1000-hp pumping units with auxiliaries. The system facilities will include a large tank farm at McCamey.

Construction of the Rancho system, which will be geared to material and equipment delivery prospects, will begin after approval of plans by PAD in Washington.

Gas Storage Project Application Changed

Mississippi River Fuel Corporation of St. Louis, Missouri, has filed an amended application with the Federal Power Commission in connection with its proposal to develop the Waterloo, Illinois, oil field as an underground storage reservoir for natural gas.

The amended application was filed following tests of the field made pursuant to a temporary certificate granted by the FPC last January 12.

As now proposed, the project would include about 16.2 miles of pipe line; an estimated 25 wells for the introduction and withdrawal of gas; an 1800-hp station for compressing the gas for injection into the reservoir; a dehydration plant with a capacity of 75,000,000 cu ft a day; liquid separators; pressure regulating and metering stations, and other incidental facilities.

Total investment cost of the project is estimated at $2,953,125.

In its original application, filed January 5, Mississippi proposed to build about 13 miles of pipe line, to drill 25 wells, and to construct regulating and metering equipment. Estimated cost of those facilities was $1,900,798.

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for pinhole or corrosion leaks.

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California Companies Seek Gas Increase

Southern California Gas Company and Southern Counties Gas Company of California, both of Los Angeles, California, have filed a joint application with the Federal Power Commission for authorization to build pipe line facilities that would carry an additional 150,000,000 cu ft of natural gas a day to southern California.

The two companies jointly own a pipe line extending from the Arizona-California border to a point near Los Angeles, and in the new application are proposing to increase its capacity from 405,000,000 cu ft a day to a total of 555,000,000 cu ft.

The proposed project includes the construction of about 81 miles of 30-in. pipe paralleling the existing line between Whitewater and Desert Center, both in California. The companies would construct another section of 30-in. loop line, about 6 miles long, between the Blythe, California, compressor station and the California-Arizona boundary, and install two 1760 hp compressors at the Blythe station.

The two companies presently receive gas from El Paso Natural Gas Company at a connection on the state line, and the application says that arrangements have been made for El Paso to deliver the additional 150,000,000 cu ft. El Paso now has pending before the commission an application for authorization to construct the facilities necessary to deliver this gas.

Estimated cost of the project is $7,767,525.

Permit Asked for Short California Line

Southern California Gas Company and Southern Counties Gas Company of California, both of Los Angeles, California, have filed a joint application with the Federal Power Commission asking authority to build a 23.5-mile natural gas pipe line in California extending from Inglewood to Los Angeles.

Estimated cost of the proposed 30-in. line is $2,611,875. The two companies would jointly own about half of the line, with the other half being owned solely by Southern California Gas Company.

The application says that the primary purpose of the proposed line is to increase deliverability of gas, withdrawn from the La Goleta, California, underground storage field, to the Los Angeles metropolitan area. The companies said the line also could be used to move gas in the event of emergency interruptions or failure of supplies from portions of their existing system.

Hope Authorized to Lay Connecting Line

The Federal Power Commission has authorized Hope Natural Gas Company, of Clarksburg, West Virginia, to build approximately 32.5 miles of pipe line in West Virginia connecting the company's natural gas transmission system with the Terra Alta gas field.

Hope plans to transport natural gas from its Terra Alta production area to its local distribution system in Fairmont, West Virginia, in order to meet increased requirements of customers in that area and to deliver any excess gas into its general pipe line system. Estimated cost of construction is $831,000.

East Tennessee Files Amended Application

East Tennessee Natural Gas Company, of Chattanooga, Tennessee, has filed an amended application with the Federal Power Commission in connection with a proposal to extend its natural gas transmission system to provide new service to several Tennessee communities and industries.

East Tennessee is now asking the FPC (1) to order Tennessee Gas Transmission Company, of Houston, Texas, to supply up to 40,000,00 cu ft of natural gas a day for resale to the markets East Tennessee is proposing to serve, and (2) for authorization to build a 100-mile 16-in. pipe line from a point south of Knoxville to the Kingsport, Tennessee area, with necessary connections, laterals, meters, and regulating and measuring equipment.

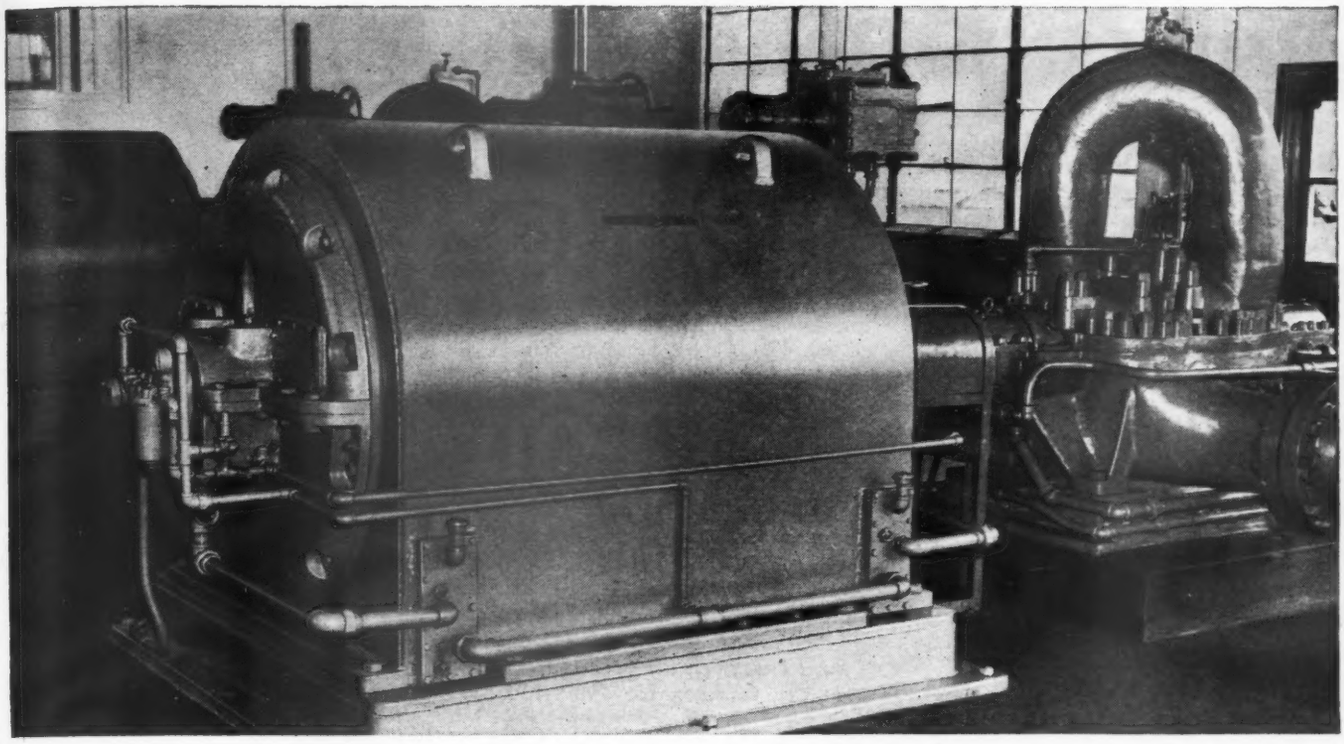
Estimated cost of the construction is approximately $5,200,000.

East Tennessee's original application was filed in March, 1950, and proposed the construction of a pipe line from a point south of Knoxville to Bristol. Estimated cost of that construction program was $5,264,120.

A 41-Mile Line Sought for Iowa

Iowa-Illinois Gas and Electric Company, of Davenport, Iowa, has filed an application with the Federal Power Commission in connection with the proposed construction of a 41-mile pipe line in Iowa to provide capacity to serve increased loads and to protect service to the Iowa City and Cedar Rapids areas.

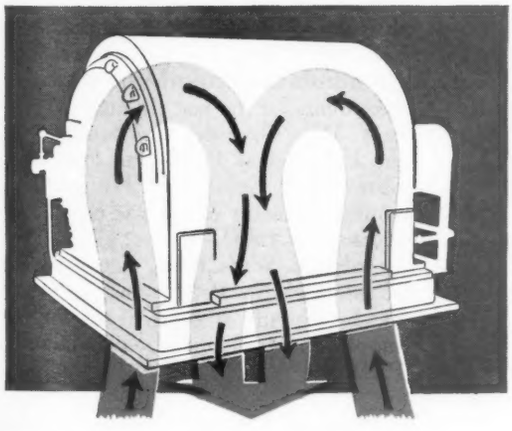
The proposed line, estimated to cost $1,000,000, would connect with the main line of Natural Gas Pipe Line Company of America in Washington County and extend northward to Cedar Rapids. The 10-in. line would parallel an existing feeder line.



These two G-E forced base-ventilated motors—each rated 1500 hp, 2300 volts, 3600 rpm—drive centrifugal pumps in the Mayersville, Miss. station of the Mid-Valley Pipeline Company's 22-inch crude oil line. Two other stations in this 1000-mile line are similarly equipped.

All-enclosed cooling... all-around protection!

In new oil pipeline station, G-E motors require no extra equipment; separate motor-driven blowers remove motor heat, keep out hazardous gases



Simplified sketch shows how air inlet and outlet passages in motor's base all open directly down through the foundation to the source of ventilating air. By first starting a separate motor-driven blower, any hazardous gases are cleared from the main motor before latter is started.

Driving pipeline pumps that deliver 157,000 barrels per day, these two General Electric 1500-hp forced base-ventilated motors with separate motor-driven blowers combine both protective and low-cost advantages:

(1) Separate motor-driven blower—started up in advance—purges the main pump motor and duct system of any gases that may have accumulated during a shutdown period. It also removes heat quickly and effectively from the main motor during operation.

(2) Base ventilation—with both intake and discharge ducts located below floor level—does away with unsightly piping and the possibility of hazardous leaks through exposed pipe joints. In addition, a firewall between motor and pump is generally not needed, further reducing station construction costs.

These motors are part of a broad G-E line for every electrified pipeline need. Let a G-E pipeline specialist help you select the right motors for *your* pipeline, and write for bulletin GEA-5423 on electrification of oil pipelines. *General Electric Co., Schenectady, N. Y.*

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Everything you need to cut oil pipeline costs —ELECTRICALLY!

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PIPELINE PERSONALS

▸ **Warren L. Ambrose,** of the crude oil supply and transportation division of the Cities Service Oil Company, Delaware, has been transferred from the Midland office to Fort Worth, Texas. **George Nolley** moves from Fort Worth to Midland where he is area representative. **Alan C. Roberts,** formerly with the crude oil department of Humble Oil and Refining Company, Houston, is being sent to Midland to assist Nolley and to replace **M. A. Wilson, Jr.,** who has been recalled to service.

▸ Allan Edwards, president, of Allan Edwards, Inc., Tulsa, Oklahoma, has announced the addition of two more engineers to his staff.

J. D. "Jeff" Irons is a graduate in petroleum engineering from Tulsa University. Irons worked as a chemical engineer for the DuPont Company and as liaison engineer for Douglas Aircraft Company. He entered the U. S. Navy in 1943 as an ordnance officer specialist. In 1946, he joined the petroleum production engineering staff of Stanolind Oil and Gas Company as a trainee. He joined Edwards as chief engineer in 1948, later joining the

J. D. Irons

Dave Moss

Peerless Manufacturing Company, also as chief engineer. Irons developed the Peerless Hi-Surface Horizontal Separator and holds patents in the natural gas dehydrating field. He is a member of ASME, ISA, and AWS.

Dave Moss is a metallurgical engineering graduate of Michigan College of Mining and Technology. He was employed as a research and process metallurgist of Western Cartridge Company until joining the Corps of Engineers as a construction and maintenance officer during World War II. Prior to joining Edwards, Moss was a contact metallurgical engineer in the Mid-Continent Area for Jos. T. Ryerson and Son, Inc.

Allan Edwards, Inc., is the manufacturer and distributor of pipe line weights and many other specialties.

▸ **Burt E. Hull,** vice president of The Texas Company and former president of Trans-Arabian Pipe Line Company, has retired after 46 years in the oil business.

Widely known in the oil and pipe line industries, Hull was first employed by The Texas Company in 1905 as a junior engineer and draftsman. Among his more recent engineering achievements was the giant 1068-mile TAPline from the oil fields of Saudi Arabia to Sidon on the Mediterranean coast. During World War II he was vice president and general manager of War Emergency Pipe Lines, Inc., which constructed the "Big Inch" and "Little Inch" pipe lines from Texas to the East Coast.

Hull was born in Navasota, Texas, and was working for *The Houston Post* when the Lucas gusher blew in on the morning of January 10, 1901. During the early morning hours he was a route carrier; during the rest of the day he served as bill collector. He made his first contact with the oil business when the paper sent him to Beaumont to negotiate advertising for oil operators and promoters.

In the fall of 1901, 17-year-old Burt Hull went to Bryan, Texas, where he enrolled at Texas A. & M. College. Three years later he was graduated with an engineering degree. His first job out of college was junior engineer for the Southern Pacific railroad.

Hull's Texaco service—he was the oldest employee in point of service at the time of his retirement—spans the company's history almost from the beginning. He was hired in 1905 at Beaumont as a junior engineer and draftsman. He got his initial pipe line experience by surveying the route and performing other engineering services in connection with the extension of the original Texaco pipe line from its terminus at Sour Lake to Humble in 1905, and from Humble to Tulsa in 1907. Later, in 1907, he went to Dallas, where he helped build company's West Dallas refinery. From there he went to Texaco's West Tulsa Works, then to Port Arthur Works as junior construction engineer. Two years later he was appointed chief engineer of the refining department, with headquarters in Houston. In this post he supervised the engineering, design, and construction of several additional refineries and most of Texaco's Gulf and Atlantic Coast terminals. He also directed construction of topping plants at Tampico and Agua Dulee, Mexico.

In 1922, Hull went to Tampico as vice president and general manager of

Burt E. Hull

The Texas Company of Mexico. Returning to Houston, four years later, he was elected president and manager of The Texas Pipe Line Company. He also became president and manager of the Texas-Empire Pipe Line Company, the Kaw Pipe Line Company, and the Texas-New Mexico Pipe Line Company.

Hull plans to make his home in or near Dallas.

▸ **George A. Wilson,** president of the Interstate Natural Gas Company of New Orleans, Louisiana, has been appointed director of the supply and transportation division of the Petroleum Administration for Defense. He succeeds **Dene B. Hodges,** who will now go to London on assignment for Shell Oil Company. He has been on leave from Shell, of which he is a vice president, for the last six month.

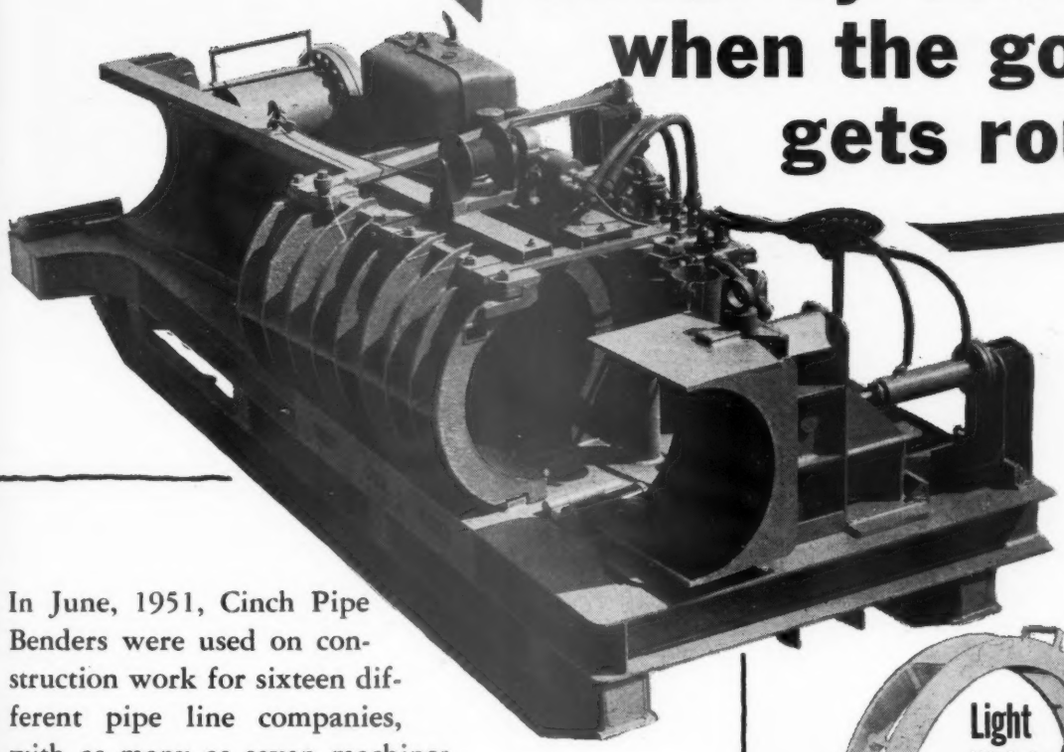
A. Dale Greene, vice president of the United Gas Pipe Line Company, Shreveport, Louisiana, has been appointed director of the gas operations division of PAD.

John A. Walstrom, vice president of the Asiatic Petroleum Company, has been made director of the foreign supply and transportation division of PAD.

▸ **Orris E. "Bud" Carter,** training supervisor for Interstate Oil Pipe Line Company, Tulsa, Oklahoma has accepted a position with Creole Petroleum Corporation in Venezuela. His new duties will be designing, developing, and presenting training programs to supervisors and foremen. His headquarters will be in Caracas.

▸ **Joe E. Stark,** formerly an apprentice oiler at the Beatrice station of Northern Natural Gas Company, has been transferred to the dispatching department of the Omaha office as a meteorologist-dispatcher.

contractors swear by CINCH when the going gets rough



In June, 1951, Cinch Pipe Benders were used on construction work for sixteen different pipe line companies, with as many as seven machines on one line.

Although most of the machines are used on 26-inch and 30-inch lines, they also do a very satisfactory job on lines ranging from 16-inch to 32-inch diameter.

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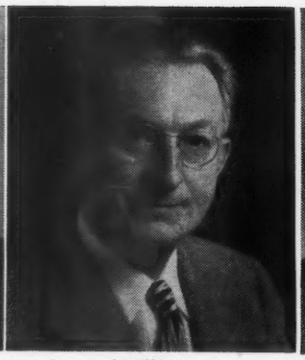
▸ **Grove Lawrence** has been elected vice president of Southern California Gas Company, to succeed **William Moeller, Jr.**, retired.

A graduate of Stanford University, Lawrence has been with the gas company since 1925. He served as an engineer in the company's operations in Taft, Ventura, and Newhall for a period of 10 years. In 1938 he was made superintendent of transmission at Taft, and in 1943, he moved to Los Angeles as manager of the company's compression and storage department. When the company's gas plant in Los Angeles was converted to the manufacture of butadiene as part of the government's synthetic rubber production program in 1943, Lawrence became manager of the butadiene production department. After the war he returned to his former post and was made assistant vice president with headquarters in Los Angeles.

At the time of his retirement on July 1, Moeller had completed more than 44 years in the gas business in Southern California and the Middle West. A native of New York and a graduate of Stevens Institute of Technology in Hoboken, New Jersey, he joined the Kansas Natural Gas Company, Independence, Kansas, in 1907 as an engineer.

Grove Lawrence



William Moeller, Jr.

Major Louis F. DeLuce

▸ **Robert V. Sellers** of Bartlesville, Oklahoma, who has been with the crude oil supply and transportation division of Cities Service Oil Compan, (Delaware), has been named technical assistant to the director of the production division, Petroleum Administration for Defense. He will be stationed in Washington, D. C.

▸ **Major Louis F. DeLuce,** Tulsa, Oklahoma, industrial relations research supervisor, Service Pipe Line Company, has reported for active duty to the anti-aircraft and guided missiles center, Fort Bliss, Texas. Separated from the army in December, 1945, DeLuce assisted in organizing Service Pipe Line's procedure department, then in 1946 set up the research section he was in charge of at the time of his recall to active duty.

The section is concerned chiefly with research pertaining to labor negotiations and contracts; revisions of employee benefit plans, as well as special research studies.

▸ **Eugene D. Milener** is the new secretary of the Natural Gas Department of the American Gas Association and will make his headquarters in New York City. **George H. Smith,** director of the department, will continue in that capacity, although a considerable part of his time will be spent in the association's Washington office, to which he eventually will move.

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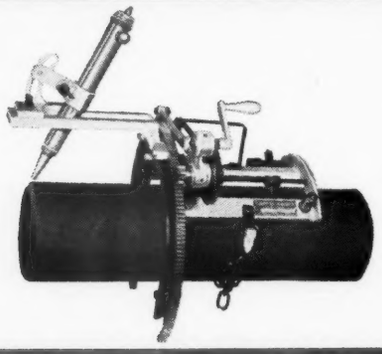
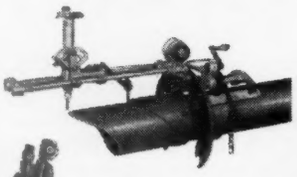


ATTACHMENTS



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portability . . Bring this light (24 to 155 pounds) but durable machine to the pipe instead of moving the heavy pipe to the machine. Remember, H&M designs for SPEED and ECONOMY.

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4. Telescopic boom locks at 14" intervals for quick changes in depth.
5. Boom shifts across full width of machine, cuts within 15" of either side for offset digging.
6. Reversible conveyor shifts by power through machine in 1 minute, discharges spoil to right or left side.
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8. Friction clutches accurately control digging, boom hoist, steering, traction, engine speed.
9. Tractor-type crawlers are self-cleaning . . . 3-point suspension mounting provides 8" oscillation on uneven terrain.

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With the PIPE LINE CONTRACTORS

N. A. Saigh Company, Inc., Suite 531 Majestic Building, San Antonio 5, Texas, got underway July 16 on 80 miles of 30-in. for Texas Eastern Transmission Corporation between Columbia and Boonesboro, Kentucky. The field office is at 109 North Central Avenue, Campbellsville, Kentucky. Phone: 373. Carl Doyle is superintendent, Hubert Hutchins and Raymond Doyle assistant superintendents. James E. Gray is office manager and Jesse Cobb chief inspector. Foremen are: Carl Avrett, welders; J. N. Childress, dope; H. N. Russell, right-of-way; W. B. Uehling, stringing, and Charley Warren, pipe. James R. Scott is material man.

H. L. Gentry Construction Company, 921 East Michigan Avenue, Jackson, Michigan, is doing considerable city work for the Ohio Fuel Gas Company. At Toledo and Fostoria an indeterminate amount of work is in progress and at Parma a total of 9 miles of pipe will be laid. Pipe sizes vary. The spreadmen are Newton Dukes at Toledo, A. J. Brown at Parma, and Milo Larsen at Fostoria. At the Bradford, Pennsylvania, compressor station of United Natural Gas Company, 10 meter runs with bypasses are being installed under the direction of Ronald Stowers. James G. Mitchell is general superintendent over all the above work.

Near Pittsburgh, Pennsylvania, 13 miles of 16-in. pipe is being laid for the Equitable Gas Company, including a crossing of the Ohio River. This job is under the direction of Frank Morris with Lavern Curtis spreadman.

About August 15 work will begin on 32 miles of 20-in. near Charleston, West Virginia, for United Fuel Gas Company.

H. C. Price Co.—Pipeline Division. General contract covering construction of approximately 156 miles of 24-in. high pressure natural gas pipe line for Tennessee Gas Transmission Company between Hamburg, New York, and the Onondaga-Madison county line, New York. Work was 65 per cent completed as of July 10. Spreads located as follows:

Auburn, New York—G. A. Reutzel, superintendent; W. E. Yount, office manager; J. A. Hairston, R-O-W-foreman; L. J. Loncarich, ditch; J. C. Anderson, bending; H. C. Morrison, pipe; K. N. Adkins, pipe; R. W. Orr, welding; S. J. Wood, coating; A. L. Bell, lower in; T. E. Walker, clean up; J. H. Ingram, Sr., chief mechanic.

Warsaw, New York—R. K. Shivel, superintendent; W. R. Crego, office manager; J. D. White, R-O-W foreman; W. H. Olrich, ditch; J. H. Latham, bending; Delbert Shivel, pipe; R. L. Ezell, welding; J. B. Northcutt, coating; C. W. Sisco, lower in; Sam Price, clean up; Cleo Robertson, road crossing; Tommie Stammer, chief mechanic.

General contract covering construction of approximately 193 miles of 30-in. high pressure natural gas pipe line for Texas Illinois Natural Gas Pipeline Company from Trinity River northeastward to the Texas-Arkansas line near Texarkana. Work was 60 per cent completed as of July 10. Spreads located as follows:

Atlanta, Texas—C. E. Shivel, superintendent; D. H. Johnston, office manager; C. F. Jones, R-O-W foreman; R. H. Edwards, R-O-W; Ray Drewell, ditch; J. V. Huff, bending; E. D. Worley, pipe; John Stokes, welding; Henry Hill, coating; Bill Buchanan, lower in; Paul McCormick, clean up; Boyd Danner, chief mechanic.

Livingston, Texas—C. R. Ice, superintendent; G. A. Harvey, office manager; W. O. Elliott, R-O-W foreman; Jessie Cash, R-O-W; E. W. Whisenant, ditch; Forest Loinette, bending; W. T. Dickerson, pipe; L. O. Reutzel, welding; N. D. Adams, coating; J. C. Rich, lower in; John E. Hamilton, clean up; Cliff Birmingham, chief mechanic.

Bechtel Constructors, Inc., 220 Bush Street, San Francisco, California, is laying 120 miles of 24-in. pipe for Tennessee Gas Transmission Company from Hamburg, New York, to the Hudson River. The work is in progress. The project office is at Richfield Springs, New York, P. O. Box 789. R. L. Bowman is general superintendent; W. H. Molander office manager.

Smith Contracting Corporation, 205 Northwest Seventh Street, Fort Worth, Texas, is laying 57 miles of 10-in. pipe for Service Pipe Line Company from the Salt Fork of the Brazos River near Throckmorton, Texas, to Humble's Jud station near Haskell. To July 24, 10 miles had been laid. The line is of old pipe and a reconditioning yard has been set up at Haskell. Herb Smith is superintendent, Jim McKnight spreadman, and John Briggs office manager. The field office is at Throckmorton.

Mahoney Contracting Company, 2300 North Grand River, Lansing, Michigan, to July 20, had completed 165 miles of the 186 miles of 26-in. being laid for Trunkline Gas Company from Joppa to Tuscola, Ill.

Work is just beginning on 100 miles of 30-in. for Texas Eastern Transmission Corporation, from the Kentucky River to the Ohio River in northeastern Kentucky. Ten miles had been completed of the total of 30 miles being laid for this same company from Connelsville, Pennsylvania, to the Oakford storage area near Greensburg, Pennsylvania. This is 30-in. pipe also.

A start has been made on the Lake Maracaibo crossing for Shell-Caribbean Venezuela, S. A. This will be a 10-mile, 20-in. crossing. A 4-mile, 30-in. crossing of the Gulf of Coro for the same company also will be installed. Both jobs will be in charge of Angelo Tavernaro.

The Dow Chemical Company work is about half completed. This consists of about 70 miles of 8-in. through 24-in. short lines in the area of Bay City, Midland, and Saginaw, Michigan.

Harold Finnerty is general superintendent for the contractor.

Midwestern Constructors, Inc., 105 North Boulder, Tulsa 3, Oklahoma, had completed the middle of July approximately 75 per cent of the 100-mile section of 30-in. between the Mississippi River near Chester, Illinois, and Effingham, for Texas Illinois Natural Gas Pipe Line Company. The field office has been moved from Carlyle to Vandalia, Illinois. John Work is superintendent. This is Schedule 11.

Work has not yet begun on Schedule 12, 100 miles of 30-in. from Effingham to Sibley, Illinois.

Schedule 13, 92 miles of 30-in. from Sibley to Joliet, Illinois, is approximately 50 per cent completed. The field office is now at Fairbury, Illinois. Denver Franklin is superintendent.

Station work for Panhandle Eastern Pipe Line Company is about 80 per cent completed at all points. F. C. Snavely is superintendent and Morris D. Garey office manager at Tuscola, Illinois. J. A. Bard is superintendent at Zionsville, Indiana. Earl S. Powell is superintendent and H. H. Voss office manager at Edgerton, Indiana.

Construction is to begin immediately on the installation of approximately 10,000 ft of 8-in. cast-iron pipe for the Aluminum Ore Company at Bauxite, Arkansas. W. L. Daniels is superintendent and John Hoff engineer.

Bechtel Corporation, 220 Bush Street, San Francisco, California, is proceeding with its work on 409 miles of 30-in. in Arkansas and Missouri for Texas Illinois Natural Gas Pipe Line Company. The project office is at 409 East Markham Street, Little Rock, Arkansas. E. W. Davis is division manager, R. Hamilton assistant project manager, E. G. Hayes division office manager, G. R. Curtis, project engineer, and E. C. Elting project office manager.

Spread offices are as follows:

Newport, Arkansas, general delivery—B. C. McLean, office manager.

Bald Knob, Arkansas, general delivery—S. L. Work, superintendent, C. A. Bingaman, office manager, and G. D. Page, job engineer.

Malvern, Arkansas, general delivery—V. L. Williams, superintendent, Harry Sager, office manager, and R. H. Hall, job engineer.

Arkansas River crossing, Box 349, North Little Rock, Arkansas—George Wahlgren, superintendent.

Jackson, Missouri, Box 10—C. E. Barker, assistant project manager; R. W. Jernigan, superintendent, E. C. Gavagan, office manager, and M. P. Boyle, job engineer.

Pocahontas, Arkansas, Box 122—J. F. Borger, superintendent, R. L. McElroy, office manager, and W. L. Clark, job engineer.

Jayhawk Construction Company, Inc., Box 68, Great Bend, Kansas, by July 19, had laid 54 miles of the 60-mile section between Grand Island and Albion, Nebraska, for Kansas-Nebraska Natural Gas Company. Pipe sizes are 8, 10, and 12-in. diam. For this same company a 40-mile section of 6-in. will be laid between Albion and Norfolk, Nebraska, and a 30-mile section of 6-in. from Albion to Neligh. Work has not yet begun on these two sections.

Houston Contracting Company, 2707 Ferndale Place, Houston, Texas, has the following construction work under contract:

Approximately 46 miles of 30-in. gas line for Tennessee Gas Transmission Company from the vicinity of Galion, Louisiana, south to the vicinity of Eros, Louisiana. W. H. Hayes, superintendent; M. L. Thompson, assistant superintendent; J. C. Strickler and J. B. Stoddard, office. Headquarters are at Bastrop, Louisiana. Approximately 25 miles laid to July 6.

Approximately 96 miles of 18-in. and 16-in. gas line for Mississippi River Fuel Corporation from vicinity of Ruston, Louisiana, to a point north of Marshall, Texas. Job being done with two spreads as follows:

One spread starting at Ruston and working west. E. C. Norris, superintendent; R. E. Thornton, assistant superintendent; R. J. Axsom, office. Headquarters at Arcadia, Louisiana. Began laying pipe July 12.

Second spread started at Woodlawn, Texas, and is working east. F. A. Silar, superintendent; C. V. Oliver, assistant superintendent; L. F. Redfearn, office. Headquarters, Marshall, Texas. Began preliminary work July 12 and laying pipe July 25.

Approximately 115 miles of 12-in., 8-in., and 6-in. lay and take-up for Interstate Oil Pipe Line Company in the vicinity of New Iberia, Louisiana. H. L. Leake, superintendent; S. B. Harrison, assistant superintendent; H. C. MacWhinnie, office. Headquarters, New Iberia, Louisiana. Work is underway.

Oklahoma Contracting Company, 6512 Hines Boulevard, Dallas, Texas, has laid (July 25) 95 miles of the New England system of Tennessee Gas Transmission Company and its subsidiary, the Northeastern Gas Transmission Company. The overall length of the contract was 175 miles, 21 miles of which was for Tennessee Gas. The latter has been completed. The work now is entirely on the Northeastern Gas end of the system. The section under construction by Oklahoma extends from the Hudson River just south of Albany to a point near Wilmington, Massachusetts.

Central headquarters for the project are at 1707 Page Boulevard, Springfield, Massachusetts. W. H. Law is in charge.

Spread headquarters are as follows:

Pittsfield, Massachusetts — H. A. "Red" Wiley, superintendent.

Westfield, Massachusetts—Panama Shiflett, superintendent.

Southbridge, Massachusetts—J. E. Flanagan, superintendent.

A new job just started is the installation of a crossing of the Tennessee River at Florence, Alabama, for Brown and Root, Inc., on the Texas Eastern Transmission Corporation system. Officials in charge are Paul Halbert, Aldress Kilgore, and Harry Prindle.

Brown and Root, Inc., P. O. Box 3, Houston, Texas, has a contract with United Gas Pipe Line Company covering various phases of engineering, construction, and other services on more than 1000 miles of pipe line in Texas, Louisiana, and Mississippi. In addition, the contractor is laying 88.7 miles of pipe for United from the West Bay field, Plaquemines Parish, Louisiana, to New Orleans. The diameter of the pipe varies from 6⅝ in. to 16 in. The field office is at Harvey, Louisiana. J. W. Kincy is superintendent; T. M. Strong office manager.

Anderson Brothers Corporation, 707 North Drennan Street, Houston, Texas, will add a second spread at a later date on the Triangle Pipe Line Company job, which consists of 85 miles of 10-in. pipe for products service from El Dorado to Arkansas City, Arkansas. Already one spread is working out of El Dorado, in charge of "Whitey" Myers.

The two spreads working on Michigan Consolidated Gas Company's system between Big Rapid and Farmington, Michigan, are making progress. In all, 121 miles of 24-in. will be laid. One spread has its field office at Big Rapid, where Frank Whitlow is superintendent; the other at Ithaca where Charlie Ingraham is in charge.

The contractor is working on its last section of line for Trunkline Gas Company, 65 miles from Longville, Louisiana, to the San Jacinto River in Texas. The field office is at Cleveland, Texas. J. L. Knox is superintendent and Frank Hindman office manager.

On the 90 miles of 30-in. between Drew and Holly Springs, Mississippi, for Tennessee Gas Transmission Company, Earl Saulsman is superintendent. The field office is at Batesville. Nearing completion is 68 miles of 30-in. for Tennessee Gas from Horse Cave to Campbellsville, Kentucky. The field office is at Glasgow. E. E. McCoy is superintendent.

Ray Bendure is supervising the construction of 90 miles of 26-in. for Panhandle Eastern Pipe Line Company from Toledo, Ohio, to Detroit, Michigan. The field office is at Dundee, Michigan.

Western Pipe Line Construction, Inc., Lockhart Building, Austin, Texas, is laying 121 miles of 30-in. pipe line and three river crossings for the Tennessee Gas Transmission Company. The pipe is being laid between Parsons, Tennessee, and Salt Lick, Kentucky. One spread is being supervised by Jack Hodges, working out of Dickson, Tennessee, and will lay 59 miles. A. G. Goyne is office manager at Dickson. The other spread has its field office at Mt. Sterling, Kentucky. W. B. Williams is superintendent and P. O. Rutledge office manager. The section being installed by this crew is 62 miles long. The three river crossings are the Duck, Buffalo, and Tennessee.

Williams Brothers-Davis Company, 6006 Jensen Drive, Houston, Texas, is constructing 165 miles of 30-in. pipe line for Texas Eastern Transmission Corporation, the section extending from Kosciusko, Mississippi, to Florence, Alabama. The field office has been moved to Ackerman, Mississippi. Dick Hamilton is superintendent.

Parkhill Truck Company, Box 1856, Tulsa, Oklahoma, has the following work in progress:

217 miles of 24-in. for Anderson Brothers Corporation on Trunkline Gas Company from Longville, Louisiana, to Garwood, Texas. A. L. Hill, foreman.

417 miles of 30-in. pipe, Sections 7, 8, and 10, on Texas Illinois Natural Gas Pipeline Company job for Bechtel Corporation, from Texarkana, Arkansas, to Mississippi River near Cape Girardeau, Missouri. R. M. Hiser, foreman Section 8; Frank Laubach, foreman Section 7; Charles Sampson, foreman Section 10.

300 miles of 30-in. pipe, Sections 11, 12, and 13, on Texas Illinois system for Midwestern Constructors, Inc., from Mississippi River near Cape Girardeau to Joliet, Illinois. Curtis Williams, foreman Section 11 with two gangs; Harold Deatherage, foreman Section 12.

60 miles of 26-in. for Anderson Brothers Corporation on Panhandle Eastern Pipe Line Company job in Indiana and Illinois. Ray Herron, foreman.

70 miles of 30-in. for Conyes Construction Company on Panhandle Eastern Pipe Line Company job in Indiana and Illinois. O. C. "Bud" York, foreman.

160 miles of 24-in. for Michigan Consolidated Gas Company from Detroit to Big Rapids, Michigan. Ira Gould in charge.

60 miles of 20-in. for Ray L. Smith and Son, Texas Illinois Natural Gas Pipe Line Company job, from Joliet to Elgin, Illinois. Curtis Williams, foreman.

42 miles of 10-in. for Service Pipe Line Company, reconditioning work in Nebraska. John Greer and Floyd Bridges, foremen.

85 miles of 10-in. for Anderson Brothers on Triangle Pipe Line Company system, from El Dorado, to Arkansas City, Arkansas. H. C. Peterson, foreman.

54 miles of 8-in. from Montezuma to Iowa City, Iowa, for Geneva Construction Company on Graet Lakes Pipe Line Company job. J. Stubblefield, foreman.

57 miles of 10-in. for Service Pipe Line Company from a point near Rochester, Texas, to the Brazos River near Olney.

R. H. Fulton and Company, P. O. Box 1526, Lubbock, Texas, is finishing up 184 miles of 26-in. on the Trunkline Gas Company system. The section is from Senatobia, Mississippi, to Joppa, Illinois. This will release two spreads for work on other jobs recently contracted. Fulton has entered into a contract with Colorado Interstate Gas Company to lay 250 miles of 20-in. from Kit Carson, Colorado, to the Canadian River north of Amarillo, Texas. Another project is 68 miles of 24 and 26-in. for Panhandle Eastern Pipe Line Company. These are loops between Sneed, Texas, and Olpe, Kansas.

Some 16-in. pipe has been laid on the west end of the Platte Pipe Line Company system. Only one spread has been employed as not enough pipe has been received to justify moving in more men and equipment. Altogether, this contractor will lay 570 miles of 16 and 20-in pipe on the Platte line, from Chatham station in Wyoming to Brule, Nebraska.

Cheek Construction Company, Inc., P. O. Box 491, Ulysses, Kansas, began work the first of August on a 101-mile gathering system for Cities Service Gas Company near Ulysses. The system consists of 6-in. to 22-in. pipe. Troy Cheek is spread foreman, Alton Cheek pipe foreman, Frank Holt office manager, and A. W. Charpist is in charge of doping.

Eastern Pipe Line Contractors, 1801 Mercantile Bank Building, Dallas, Texas, is laying for Texas Eastern Transmission Corporation 76 miles of 30-in. pipe from the Tennessee River near Florence, Alabama, to a point near Columbia, Tennessee. To July 18, approximately 6 miles of pipe were lowered-in. Fred Byers is general superintendent, J. W. Arthur office manager, and Cliff Simmons, spreadman.

J. L. Cox and Son (stringing contractors), Raytown, Missouri, are stringing 423 miles of 20-in. pipe on the Platte Pipe Line Company system. This is broken up into two sections, 273 miles from West Alton, Missouri, to Kenmoor, Missouri, of which 27 miles had been completed to July 21; and 150 miles from Holdrege to Odell, Nebraska.

For Service Pipe Line Company, 94 miles of 6 and 10-in. loops are being strung in Missouri and Illinois; 32 miles completed. Also for Service, 66 miles of 10-in. are being strung from the Salt Fork of the Brazos River to Bowie, Texas. This work began July 9.

Mid-States Construction Company, Inc., P. O. Box 417, Mount Vernon, Illinois, is laying 13½ miles of 10-in. pipe for Texas Gas Transmission Corporation from that company's 12-in. trunkline to the Alford storage field. Personnel as follows: Ray Koch, right-of-way and crossings; Dutch Hall, ditch; Dan Flatt, pipe and bending; Claude Jones, welders; Glen Caldwell, dope, tie-ins, and lowering-in; Paul Kelly, clean-up.

Dunn Brothers, 801 Mercantile Securities Building, Dallas, Texas, (stringing contractors), have the following jobs under contract:

Texas Illinois Natural Gas Pipeline Company, Section 5, 91 miles of 30-in. from Urbana to Dotson, Texas, and Section 6, 99 miles from Dotson to the Texas-Arkansas state line.

El Paso Natural Gas Company, 415 miles of 24-in. in New Mexico and Arizona on the San Juan line.

El Paso Natural Gas Company, 419 miles of 30-in. in New Mexico, Texas, and Arizona.

Tennessee Gas Transmission Company, between 400 and 500 miles of 30-in. from Buffalo, New York, to the Massachusetts border.

Northeastern Gas Transmission Company, 65 miles of 16-in. in Connecticut and Massachusetts.

Tennessee Gas Transmission Company, 95 miles of 30-in. from Drew to Holly Springs, Mississippi.

Tennessee Gas Transmission Company, 60 miles of 30-in. from Colesburg to Dickson, Tennessee.

Tennessee Gas Transmission Company, 60 miles of 30-in. from Salt Lick to Richmond, Kentucky.

O. R. Burden Construction Corporation, 6702 East 21st Street, Tulsa, Oklahoma, at last report, had on hand 75 miles of pipe for the Platte Pipe Line Company job and work was going ahead. The contractor expected to receive pipe steadily and in sufficient quantities to avoid a shutdown. Headquarters are at Moberly, Missouri, where Barney Hall is superintendent and Howard Smith office manager. Altogether, Burden Construction will lay approximately 280 miles of the Platte system, from the Missouri River near St. Joseph, Missouri, to the Mississippi River near Wood River, Illinois.

Between Glen Pool and Henryetta, Oklahoma, 38 miles of 8-in. pipe is being taken up and reconditioned for The Texas Pipe Line Company. Headquarters are at Okmulgee. Floyd Lewis is superintendent and Ben Mapes office manager.

For Service Pipe Line Company, 66 miles of 10-in. pipe is being laid from Bowie, Texas, to the Brazos River near Olney. A crossing of the Brazos also is being installed. Headquarters are at Olney, with Pete Hiner the superintendent and Ed Rensch office manager.

Bishop and Lock Construction Company, 1018 Magnolia Building, Dallas, Texas, is still waiting on pipe to begin the Platte Pipe Line Company job. This contractor will lay 142 miles of the line between Marysville, Kansas, and Holdrege, Nebraska.

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Associated Pipe Line Contractors, Inc., 3272 Westheimer Road, Houston, Texas, has under construction 100 miles of 20, 24, and 26-in. pipe line, which it is laying for United Gas Pipe Line Company in conjunction with J. Ray McDermott and Company. The pipe is being laid in the New Orleans area of Louisiana. The field office is at Morgan City. L. H. Gray is superintendent and James Luther and Ralph Herwig are taking care of office matters.

Work also is underway on 188 miles of 6⅝-in. between Searsport and Limestone, Maine, for the U. S. Corps of Engineers. Cecil Rogers is superintendent and A. B. Johnson office manager. The field office is at Bangor.

Texas-Louisiana-M-K, 6100 Camp Bowie (P. O. Box 9127, Arlington Heights Station), Fort Worth, Texas, has completed the 30-mile section of 30-in. pipe between Napoleonville Junction and Gonzales, Louisiana, for United Gas Pipe Line Company and is now waiting on pipe and right-of-way to go ahead with other work for this company. Yet to be laid are 215 miles of 30-in., 42 miles of 24-in., and 100 miles of various size pipe from 20-in. down. This will be laid between Lafayette and Napoleonville northeast to connect with Texas Eastern's system north of Jackson, Mississippi. The field office is at Donaldsonville, Louisiana. H. J. "Red" Tatom is superintendent and A. L. Price office manager.

Ray L. Smith and Son, Inc., Hazlett Building, El Dorado, Kansas, are laying 58 miles of 20-in. pipe line between Joliet, Illinois, and the Volo meter station for Texas Illinois Natural Gas Pipeline Company. Approximately 6 miles had been completed to the middle of July. The following personnel are in charge: R. M. Jones, superintendent; D. L. Marley, office manager; Charles Lewis, welders; Carlos Gayhart, pipe; Charles Pierce, pipe; C. N. Leggitt, ditch; "Hub" Cisco, bending, and Rex Pickens, lowering in.

H. B. Zachry Company, P. O. Box 2570, San Antonio, Texas, has begun work for Texas Eastern Transmission Corporation on 74 miles of 30-in. pipe line from a point near Columbia, Tennessee, to the south side of the Cumberland River in northern Tennessee.

Tulsa Pipe Coating Company, 517 Palace Building, Tulsa, Oklahoma, is coating 20 miles of 12-in. pipe for the Oklahoma Natural Gas Company, which is being laid between Marshall and Enid, Oklahoma. Bob Pierce is superintendent. For Northern Natural Gas Company, 80 miles of 26-in. pipe are being coated. This is being laid from Beatrice, Nebraska, to Clifton, Kansas. Buck Rogers is in charge. Associated Natural Gas Company is having 147 miles of 2-in. through 8-in. coated, which will be used at Sikeston, Missouri. Hamilton DuBose is superintendent. Twenty miles of 4-in. are being coated for the Rock Island Refinery at Maysville, Oklahoma. Gaines Laster is superintending this job.

Latex Construction Company of Georgia, Box 56, Northside Branch, Atlanta, Georgia, is doing pump station and terminal work for the Plantation Pipe Line Company. Station buildings are being enlarged to house additional units at Baton Rouge, Louisiana; Collins, Mississippi; Akron and Silver Run, Alabama; Bremen and Center, Georgia, and Spartanburg, South Carolina. Terminals are being enlarged at all main points between Baton Rouge and Charlotte, North Carolina.

George Tucker Pipe Line Construction, P. O. Box 1987, Odessa, Texas, got under way the latter part of July on a 140-mile gathering system in West Texas for the Lion Oil Company of El Dorado, Arkansas. This will be a 10-psig system for the Diamond "M"-Sharon Ridge gasoline plant about 10 miles out of Snyder. Pipe sizes will range from 6 in. to 30 in. The work is scheduled for completion about October 30.

Oman Construction Company, Inc., Box 146, Nashville, Tennessee, began work in July on 79½ miles of 30-in. pipe line in Kentucky for the Texas Eastern Transmission Corporation. The field office is at Columbia. M. W. Smith is superintendent.

Lewie Montgomery Trucking Company (stringing contractors), Box 432, Odessa, Texas, is stringing 30 miles of 6, 8, and 10-in. pipe for McVean and Barlow Construction Company in Midland and Upton counties, Texas. Pete Tyner is superintendent. Also for McVean and Barlow, 15 miles of 4 and 6-in. pipe are being strung in Midland and Upton counties, this pipe being used in a gathering system. Loyd Miller is the superintendent on the job.

Trojan Construction Company, 1416½ North Robinson, Oklahoma City, Oklahoma, began work the middle of July on 54 miles of 10¾-in. pipe line for Shell Pipe Line Corporation, from Cleveland to Chelsea, Oklahoma. Charles T. "Swede" Tillotson is superintendent and Vernon Yeager office man. The field office is at Collinsville, Oklahoma.

Williams Brothers Company, National Bank of Tulsa Building, Tulsa, Oklahoma, has the following jobs in progress or contracted:

For Plantation Pipe Line Company, 712 miles of 14 and 18-in. pipe line from Baton Rouge, Louisiana, to Charlotte, North Carolina. George Allen is general superintendent. The central office is at Tuscaloosa, Alabama. Spread offices are located as follows:

Athens, Georgia—T. E. Davis, superintendent; J. E. G. Jester, office manager.

Meridian, Mississippi—A. T. Maxwell, superintendent; Joe Breedlove, office manager.

Tylertown, Mississippi—O. R. Mitchell, superintendent; R. J. Purdy, office manager.

The fourth spread under Whitey Martin recently completed its section, working last from Columbiana, Alabama.

For New York State Natural Gas Corporation, 78 miles of 20-in. from South Bend, Pennsylvania, to Petersburg, on the Pennsylvania-Ohio state line. The field office is at Leechburg, Pennsylvania. Clyde Gregory is superintendent and Walter Hammond office manager.

For East Ohio Gas Company, 65 miles of 26-in. from Cleveland to Petersburg, Ohio.

For Venezuelan Atlantic Transmission Corporation, 195 miles of 10, 12, and 16-in. from Las Mercedes to Caracas.

For Shell Caribbean Petroleum Corporation, 160 miles of 30-in. from Palmerejo, near Maracaibo, to Punta Cardon, Venezuela. Both projects are under the supervision of Marvin Jones, who has his headquarters at Caracas.

Conyes Construction Corporation, 2884 San Pablo Avenue, San Pablo, California, is laying a total of 140 miles of 30-in. pipe line for Panhandle Eastern Pipe Line Company, using two spreads. The section from Tuscola to Zionsville, Indiana, is 75 miles; from Zionsville to Fort Wayne, 65 miles. Jimmy Allman and Morris Norwood are the spread superintendents.

G. G. Griffis Construction Company, 2514½ East 15th Street, Tulsa, Oklahoma, is just getting started on its job for Northern Natural Gas Company, which consists of laying approximately 210 miles of 26-in. pipe in Texas, Oklahoma, Kansas, and Nebraska. Field headquarters have been established at Beatrice, Nebraska, north of which the initial work is being done. G. L. Mims is general superintendent, E. G. Grisham spreadman, and Mont Wood office man.

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NEWS

Phillips Wins FPC Decision

According to a Federal Power Control ruling, Phillips Petroleum Company does not come under its jurisdiction on sales of natural gas to pipe line companies for interstate transportation and resale. In a letter to Mon Wallgren, FPC chairman, Senator Alexander Wiley, Wisconsin, has requested a hearing of the case.

The preliminary decision was made after many weeks of testimony before the FPC, wherein Phillips sought to prove that the Commission had no jurisdiction over rates charged by Phillips for the natural gas it supplies to five pipe line companies for resale. Although the decision can be changed, beginning the struggle all over again, oil companies hope that Congress will again pass legislation defining FPC functions under the Natural Gas Act. President Truman vetoed the Kerr bill, which allowed companies to sell gas on the open market if they did not themselves sell it in that state.

Gasoline Prices Down In Winnipeg Area

Wholesale prices on gasoline in the Winnipeg, Canada area were reduced two cents a gallon by Imperial Oil as the company began full operation of its $10,000,000 refinery at East St. Paul. This reduction, together with previous reductions, makes the Winnipeg wholesale price 5.2 cents lower than it was last October, reflecting benefits of western oil production and lower transportation costs now that Imperial can displace imports from Ontario with Manitoba products.

Furnace fuel oil prices were reduced one cent and diesel oil prices one-half cent in the Winnipeg area.

Scrap Steel Supply Low

Inventories of scrap iron and steel at the Nation's 200 mills and foundries are dangerously low, and unless scrap supplies are appreciably expanded within the next four months the steel production program faces a serious threat of being crippled, an emergency conference on scrap recovery, attended by industrial and Federal government officials, has been advised.

Manly Fleischmann, Administrator of the National Production Authority, warned that without a sufficient supply of scrap steel, which is essential to the production of new steel, a lag in the steel program would affect not only defense-supporting industries but would limit production of civilian consumer goods.

Oil Industry Faces Severe Steel Cutback

With a severe shortage in steel allotment for the third quarter, the oil and gas industry is facing a similar cutback in the fourth. So far preliminary fourth quarter requirements are about 2,335,000 tons for the oil industry, Petroleum Administrator for Defense, Chapman has told a Senate Committee. Realizing other vital defense demands must also be met, he stated that the petroleum industry was asking for only 2,135,000 tons. Chapman told a senate interior committee that the 1,583,000 ton allocation of steel for the petroleum in the third quarter was only 67 per cent of actual requirements.

The Defense Production Administration has announced that such cutbacks are essential, but so far the oil industry has not given in to what has the appearances of the inevitable. The Independent Petroleum Association of America is using as its greatest challenge some rather imposing figures on unprecedent rise in exported tubular goods. The IPAA magazine reports that during the first four months of the year, 187,000 tons of pipe line and oil country goods have been exported, making an annual rate of 561,000 tons if permitted to continue at this high rate until the end of the year. This is eight times the average for the 1935-1939 period.

In Washington a senate committee is investigating the shortage of steel to the oil industry. The committee has revealed that after allocations for military purposes, essential consumer goods, and automobiles were met, only 14,000,000 tons were left to meet demands for 22,000,000 in the third quarter. The petroleum industry, getting its quota out of the 14,000,000 tons got only about two-thirds of its estimated needs.

U. S. Oil Imports

Imports of foreign oil and products totaled 757,900 bbl for the week ended July 21, the American Petroleum Institute reported. This compared with 806,000 bbl for the week ended July 14. For the four weeks ended July 21, a total of 835,600 bbl were imported.

The following table includes figures on imports of crude and residual oil as set out by the API:

Four weeks (average) ended	Crude oil	Residual oil	Other products	Total
July 21	599,200	215,300	20,800	835,600
Week Ended				
June 16	689,500	238,600	15,100	943,200
June 23	491,100	233,900	29,000	754,000
June 30	551,600	247,700	22,100	821,400
July 11	764,300	173,500	18,400	956,200
July 14	541,000	238,200	27,600	806,800
July 21	541,200	201,700	15,000	757,900

Iran, Britain Talks Will Be Resumed

Britain has made arrangements to send a cabinet mission to Iran for another try at settling its oil dispute with that country. W. Averell Harriman, U. S., met with British and Iranian government officials in an attempt to bring the two countries together for continuation of the talks recently terminated.

Iran will not interfere with the "technical aspects" of the oil drilling and refining, if Britain will accept the authority of the National Oil Company, Iran's successor to the British-owned Anglo-Iranian Oil Company, Sen. Matine Daftari, premier Mohammed Mossadegh's son-in-law and a member of the oil board, announced.

Back in the United States the government and 19 American oil companies with overseas oil production agreed to supply oil to help the friendly nations affected by Iran's oil industry. A Foreign Petroleum Supply Committee has been formed, with Stewart P. Coleman, Standard New Jersey director, as chairman.

Oil At the Front Door

The *Western Nebraska Observer*, Kimball, Nebraska's weekly newspaper, brought oil to its readers' front doors recently upon discovery of the county's first oil well. A spot of oil was put on the first page of each newspaper so the readers could see it firsthand.

Canada Will Aid Colombia

An agreement has been signed between Colombia and two oil companies of Canada for the latter to give technical advice in Colombian exploration and refinery practice. When the Tropical Oil Company's contract expires this month, The National Petroleum Company, government-operated company of Canada, will take over operation of a large concession in Colombia. The other Canadian company, International Petroleum, has agreed to loan Colombia $10,000,000 to enlarge the refinery and construct an oil pipe line that would connect Bogota with one of the major oil fields on the Magdalena River.

Chapman Meets With Bermudez, Pemex Head

Back in the U. S. after a 2-day visit with Antonio Bermudez, head of Pemex, Mexican government oil company, Interior Secretary Chapman declares there is now a better understanding between the two countries. He said his offer to trade steel for Mexican oil was given a warm reception, and announced that U. S. had allotted enough pipe steel to Mexico to drill 65 wells in July, August, and September. Chapman denied rumors that he and Mexico's President Aleman had reached an agreement on the return of American oil companies to Mexico.

API Plans Gas Course

A new course is being planned by the American Petroleum Institute to teach procedures for handling natural gas. The course, which is to be ready in 1952, will be taught in connection with the University of Texas. Vocational training departments of oil-producing states will send out traveling instructors with mobile trailer demonstration equipment. The API, which began its educational program in 1933, has two other courses currently under way: Treatment of oil field emulsions and operation of pumping engines.

Warren To Store Fuels In Limestone Cave

Warren Petroleum Corporation has been granted permission by the Texas Railroad Commission to store its butane and propane liquids in a cave dug near Breckenridge, Texas. The million-gallon cavern is near the Breckenridge gasoline extraction plant. Limestone walls will keep the fuels from leaking out, the corporation claimed.

Petroleum Statistics Out

DeGolyer and McNaughton has announced availability of the seventh annual edition of Twentieth Century Petroleum Statistics. A statistical history of the world petroleum industry, the publication was first done for the Navy Department.

Carter Oil Intensifies Utah Oil Exploration

Carter Oil Company has announced tentative plans for a refinery in Salt Lake City, Utah, and a pipe line to the Pacific Coast as a part of its $5,000,000 petroleum exploration program in Utah. The company has a $10,000,000 exploration program in progress in Uintah Basin, with an increase of 25 per cent in the entire Rocky Mountain area this year.

Former PESA President Ted Sutter greets new president, F. M. Mayer, and vice president, Mason B. Jones.

PESA Holds 16th Annual Meeting in Canada

The sixteenth annual meeting of the Petroleum Equipment Suppliers' Association was held at the Chateau Frontenac, Quebec, Canada, recently. Ted Sutter, Baker Oil Tools, Inc., president, presided at the early sessions, turning over the gavel to the new officers after their election.

New officers and directors elected at the meeting were: President, F. M. Mayer, Continental Supply, Dallas, Texas; vice president, Mason B. Jones, The S. M. Jones Company, Toledo, Ohio; treasurer, Wharton Weems, Vinson, Elkins and Weems, and executive secretary, H. R. Safford, Jr., Houston, Texas.

District Chairmen

Eastern District. Chairman, H. B. Wehrle, McJunkin Supply, Charleston, and vice-chairman, A. S. Knowles, Parkersburg Rig and Reel Company, Parkersburg, West Virginia.

Mid-Continent and Rocky Mountain District. Chairman, D. D. Bovaird, Bovaird Supply, vice-chairman, E. C. Bolger, W. C. Norris, Manufacturer, Tulsa, Oklahoma.

Southwestern District. Chairman, M. E. Montrose, Hughes Tool Company, and vice-chairman, Wallace D. Wilson, Wilson Supply, Houston, Texas.

Pacific District. Chairman, J. J. Pike, Jr., Republic Supply of California, Los Angeles, and vice-chairman, W. Edgar Spear, Chiksan, Brea, California.

Directors

Eastern District. George H. Alten, Alten Foundry and Machine Works, Inc., Lancaster, Ohio; Karl Elliott, Acme Fishing Tool Co., Parkersburg; Mark Gardner, International Derrick and Equipment Company, Dallas; Jene Harper, Franklin Supply, Chicago, Illinois; Mason B. Jones, The S. M. Jones Company, Toledo, Ohio; Lloyd Lanphere, Ajax Iron Works, Corry, Pennsylvania; A. S. Knowles, Parkersburg Rig and Reel, Parkersburg; Donald W. Mackie, Bradford Supply, Bradford, Pennsylvania; Frederick F. Murray, Oil Well Supply, Dallas; A. W. McKinney, The National Supply, Toledo; Ferd J. Spang, Spang and Company, Butler, Pennsylvania; H. Bernard Wehrle, McJunkin Supply, Charleston, West Virginia.

Mid-Continent and Rocky Mountain District. Frank E. Bernsen, Lucey Products; E. C. Bolger, W. C. Norris, Manufacturer; Davis D. Bovaird, Bovaird Supply; R. A. Campbell, Hinderliter Tool, Division, H. K. Porter of Tulsa; S. J. Iverson, Iverson Supply Co., Fort Worth, Texas; Grover Kilgore, Halliburton Oil Well Cementing, Duncan, Oklahoma; W. H. Larkin, Larkin Packer Company, St. Louis, Missouri; M. G. McCool, American Iron and Machine Works, Oklahoma City; and Walter O'Bannon, Walter O'Bannon Company; J. L. Shakely, Jones and Laughlin Supply; Guy A. Thompson, Bethlehem Supply, and S. P. Wallace, Maloney-Crawford Tank and Manufacturing, Tulsa.

Southwestern District. W. T. Campbell, Mission Manufacturing Company, Houston; Ken W. Davis, Mid-Continent Supply, Fort Worth; R. G. Hamaker, Reed Roller Bit, Houston; Frank Hereford, Murray-Brooks, Inc., Lake Charles; Elliott Johnson, Schlumberger Well Surveying; J. H. Lollar, Jr., Republic Supply; Fred M. Mayer, Continental Supply; M. E. Montrose, Hughes Tool Company; Ralph Neuhaus, Cameron Iron Works; George O'Leary, Houston Oil Field Mtl. Co.; Charles Thornhill, Thornhill-Craver, and Wallace D. Wilson, Wilson Supply Company, Houston.

Pacific District. J. C. Axelson, Axelson Manufacturing Company; J. A. Crawford, Youngstown Steel Products; E. S. Dulin, Byron Jackson; Rodney S. Durkee, Lane-Wells; H. H. Glen, Emsco Derrick and Equipment; Don Grubbs, Oil Well Supply; Wendell Jones, Bethlehem Supply of California; John J. Pike, Republic Supply; Ted Sutter, Baker Oil Tools, Inc., all of Los Angeles; Edgar Spear, Chiksan Company, Brea; Otto Hammer, Security Engineering Company, Whittier, and D. S. Faulkner, National Supply, Torrance, California.

ASME To Meet in Tulsa

Approximately 40 technical papers are scheduled for the Petroleum Mechanical Engineering Conference to be held in Tulsa, Oklahoma September 24, 25, and 26. These papers concern the three principle functions in the industry — production, transportation, and refining. The Mid-Continent section of the American Society of Mechanical Engineers will act as hosts for the conference. Subjects range from equipment design to a consideration of refinery cost estimating techniques.

Louisiana Oil Map Out

The Louisiana Conservation Commission has issued a new petroleum map of that state, showing oil and gas deposits, pipe lines, refineries, natural-gasoline plants, and cycling operations. The new map also outlines fields in the disputed tidelands area.

Snyder Gasoline Plant Ships First Products

Initial shipments of liquefied petroleum gas products are being made from the new Snyder gasoline plant in Scurry County, Texas, operated by Sunray Oil Corporation.

It is expected that this new gasoline plant will produce 50 to 60 carloads (450,000 gal) of products per day; the products include propane, butane, isobutane, and natural gasoline.

Construction of the $8,000,000 natural gas project was begun in October, 1950, and proceeded on a record-breaking schedule without any undue delays. Installation of the high pressure gas-gathering system, gathering gas from 850 wells on 35,000 productive acres in the prolific Kelley-Snyder area, is estimated to have saved 4 billion cubic feet of gas that would otherwise have been flared and wasted since a year ago. This is approximately 40 per cent of the gas volume being produced in the field.

This new Snyder plant, which will process 70,000,000 cu ft of gas daily, has many unusual features of late design. These include a two-stage gas-gathering system, 57 automatic drip-condensate installations in the low pressure gas-gathering system, a de-ethanizer absorber, and the use of supercharged engines, developing 20 per cent more horsepower than conventional installations.

With Sunray Oil Corporation as operator, a seven-member advisory committee, elected by the owners, include H. W. Manley, chairman, vice president of gas-gasoline department of Sunray Oil Corporation, Tulsa, and representatives of Fullerton Oil Co., Pasadena, California; Scurry Natural Gasoline Corporation, Houston; Lone Star Producing Company, Dallas; Cities Service Oil Company, Bartlesville; L. M. Lockhart, Corpus Christi, Texas; Skelly Oil Company, Tulsa.

E. J. Mills, formerly head of Sunray's Benton, Louisiana, gasoline plant, is superintendent of the new unit, which was designed and constructed by Fluor Corporation, Ltd.

Film Folder Available

A new folder designed to promote speaking engagements for oil men and showings of films before school and civic groups has been published by the Oil Industry Information Committee. The Committee has also completed revision of its "Movies About Oil" catalog, which lists and describes more than 100 motion pictures about petroleum. Entitled "Programs on Oil," the new folder describes 13 speeches on various oil subjects, plus two Oil Industry Information Committee films, "24 Hours of Progress" and "The Last Ten Feet" films. The folder will be distributed through the 3750 local OIIC to state offices of large civic and service groups and to community and school organizations.

Diffraction Conference Set For November in Pittsburgh

The ninth annual Pittsburgh Diffraction Conference will be held at Mellon Institute, Pittsburgh, Pennsylvania, November 29 and 30, 1951. Sessions are tentatively being arranged on Instrumentation and Methods, and Metal and Alloys. Papers are solicited on these and related subjects, and will be considered in the order in which they are received. Titles should be sent to the program chairman, R. W. Turner, Carnegie Institute of Technology, Pittsburgh, before September 1.

The conference will also include a symposium of invited papers on the subject of *Diffraction and Thermomagnetic Studies of Reactions of Metastable Carbides of Iron.*

For further information, and for a copy of the preliminary program when available, write to C. W. Cline, Aluminum Research Laboratories, P. O. Box 772, New Kensington, Pennsylvania.

Iraq To Share Oil 50-50

A tentative agreement has been made between Iraq and the Iraq Petroleum Company, whereby that country will be given 50 per cent of the company's profits, payment to be made in oil. Prices of the crude will be determined based on the selling price in the Persian Gulf and Mediterranean areas.

Houston Nomads recently met and heard Henry J. Estes, Iraq Petroleum Company, discuss the oil situation in the East. Estes emphasized the importance of diplomacy in the Eastern oil situation. Pictured at the meeting are: Front row, Glenn Byers, Shell Oil, Houston; R. W. Posgate, Shell Caribbean, Maracaibo; Orlando Camargo, Shell Oil, Colombia; back row, R. J. Watson, Shell, Maracaibo; Paul von Forgach, Gerverschaft, "Brigitta", West Germany; and Estes.

Others attending the Houston Nomads meeting are: Michel Tenaille, SNPEPAL, Algiers, Algeria; R. W. Elliott, Los Angeles; M. King Hubbert, Shell Oil, Houston; J. Von Paasschen, The Texas Company, New York; and R. L. Halie, Shell Oil, Seria, British Borneo. Hubbert delivered a lecture on the evolution and progress of various forms of energy, and the probable eventual termination of those forces.

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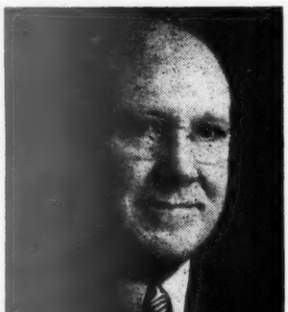
PERSONALS

▸ **P. W. Parker** has been elected to the president's office of Standard-Vacuum Oil Company. He has headed the Standard-Vacuum organization since 1946. Standard-Vacuum has announced that its chief executive officer will be the president, and that Parker, who has been chairman of the board, will continue as head of the company.

L. V. Collings, general counsel, has resigned as a vice president to become chairman of the board, thus filling the office vacated by Parker. At the same time **H. W. McCobb,** also a director, has been elected a vice president of the company.

A newly formed executive committee, headed by Parker and with Vice President **H. F. Prioleau** as its vice chairman, is empowered to function between meetings of the board of the oil company.

Edward N. Leibacher and **George F. James** have been elected directors, one to fill a vacancy created when **L. W. Elliott,** former president, recently resigned to become a director of Standard Oil Company (New Jersey). The other appointment represents an increase in Stanvac's board membership from 9 to 10. Leibacher has been coordinator at New York for the company's interests in Indonesia. James has been treasurer, and will be succeeded by **Harold Midtbo,** formerly an assistant treasurer.



David S. Kilgour

▸ **David S. Kilgour** has retired as secretary of the Western Oil and Gas Association, after 26 years with the association. Kilgour joined the association, then known as the Chamber of Mines and Oil, in 1925 as an auditor, and became successively assistant secretary and secretary, the post he held at time of his retirement.

For 11 years, from 1933 to 1944, he was also secretary of the Pacific Coast section of the division of production of the American Petroleum Institute and is currently on its advisory committee. As secretary of the Wildcat Committee of the Association, Kilgour has been instrumental in its many philanthropic endeavors, and has been a leading figure in the annual Christmas Jinks staged by the group.

▸ **Frank Rogers,** for the past five years Washington correspondent for the Los Angeles Daily News, has joined the staff of the Western Oil and Gas Association as Washington, D. C., representative. Rogers has a thorough knowledge of California and the West, gained through 15 years experience as a newspaperman on papers in Los Angeles, San Diego, Ventura, and Santa Ana.

This year he was elected secretary of the National Press Club in Washington, first West Coast newspaperman ever to be elected to an office in that organization.

▸ **M. A. Wright,** former Carter Oil Company executive, has been elected executive vice president of the International Petroleum Company, Limited. Wright has been deputy coordinator of all producing activities of Standard Oil Company (New Jersey) since November, 1949.

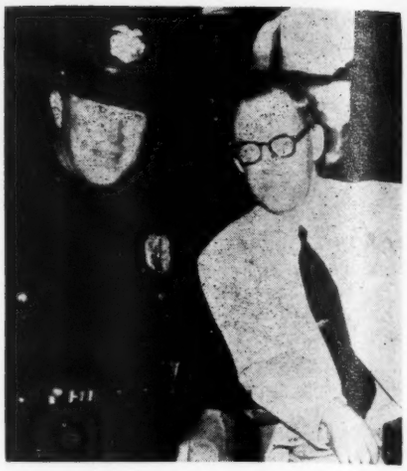
He was graduated from Oklahoma A. & M. College in 1933 with a degree in civil engineering. Immediately after graduation he joined Carter Oil Company, a Jersey Standard affiliate. After serving in various engineering positions in Oklahoma and Louisiana for Carter, he became chief petroleum engineer in 1943 and assistant manager of the production department the following year. Early in 1946, Wright became an executive assistant in the producing coordination department of Jersey Standard, and deputy coordinator of producing activities in 1949.

▸ **R. F. Marschner** has been named senior research associate for Standard Oil Company (Indiana). **B. L. Evering** was named research associate; **A. P. Lien,** section leader, and **D. R. Carmody** and **C. E. Johnson,** group leaders. All are at Standard's Whiting, Indiana, research laboratory.

Dr. Marschner was graduated from Brown University and received a Ph.D. from Penn State College in 1936. He joined Standard's research staff in 1934.

Dr. Evering received the undergraduate training at Loyola College of Baltimore, Md., and the University of Heidelberg. After receiving a Ph.D. from Johns Hopkins University in 1934, he joined Standard's research staff.

Dr. Lien was graduated from Ottawa (Kansas) University, and received a Ph.D. from Ohio State University in 1941. He joined Standard immediately upon receiving his doctorate.



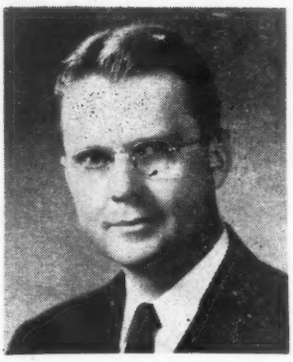
By a peculiar coincidence, the security officer at the Los Angeles Nomads' whingding at the Riviera Country Club was **C. A. Couch** of the West Los Angeles police force, a former security officer for Aramco on Bahrein Island. The suspicious looking character shown here in his custody is **Dick Sneddon,** Pacific Coast editor, *The Petroleum Engineer*. This intimate shot is from the polaroid library of Ernie Fowks, the well known "Emsconian."

▸ **Brandon H. Grove,** formerly of the producing department, Socony-Vacuum Oil Company, Inc., has been named general manager of Socony-Vacuum operations in Egypt and the Red Sea to succeed **Robert S. Stewart,** retired.

After joining Socony-Vacuum in 1935, Grove spent the succeeding four years in the company's European offices. He returned to the United States in 1940 for a training period with Magnolia Petroleum Company, Socony-Vacuum affiliate, and then went to Spain and Colombia. He was transferred to the Cairo, Egypt, office in early 1950.

Grove received a bachelor of science degree in geology and a doctor of philosophy degree from the University of Chicago.

▸ **H. E. Brandli** of New York City was elected president of Cities Service Oil Company, Pennsylvania, at a meeting of the board of directors. Brandli succeeds **Burl S. Watson,** who recently was made chairman of the executive committee. Brandli, formerly vice president and general manager of the company, is a veteran Cities Service executive. During nearly 40 years with the organization, he has engaged in all phases of its widespread interests. His activities have included key managerial positions with properties of the organization in Illinois, Texas, Kansas, Mississippi, and Alabama.



Fred H. Moore

Fred H. Moore has been appointed to the position of assistant to the president of Magnolia Petroleum Company. Moore was graduated from Texas Technological College in Lubbock. In 1931 he received his master's degree in geology from the University of Virginia, and then spent two years in the graduate school of geology at Yale University.

Moore joined Magnolia in 1935 as a field geologist in Oklahoma. He was transferred a year later to Midland, Texas, where he served four years as a geologist in West Texas. After working in the company's Kansas, Ohio, North Texas, and Illinois geological districts he was sent to Roswell, New Mexico, to open Magnolia's geological offices there in 1947. Two years later Moore was transferred to the company's general offices in Dallas as staff geologist.

F. S. R. Sedding, Doheny-Battson Interests, has been elected president of the Petroleum Accountants Society of Los Angeles for the year beginning June 1, 1951. Other officers elected are: first vice president, **J. R. Brown,** Standard Oil Company of California; second vice president, **C. F. Wilmsmeier,** Western Gulf Oil Company; secretary-treasurer, **V. T. Gilchrist,** The Superior Oil Company.

Installation of officers took place at a luncheon meeting held on June 28 at the Biltmore. Admiral Robert Wallace Berry, U.S.N. (retired), was the featured speaker.

Ray C. Hinman, in charge of Socony-Vacuum Oil Company's legislative department, has been elected a vice president of Associated Industries of New York, as well as having been re-elected a director of the association.

Poe Associates Move

E. Holley Poe Associates have announced removal of their offices to One Wall Street, New York City. The telephone number is Whitehall 3-6235.

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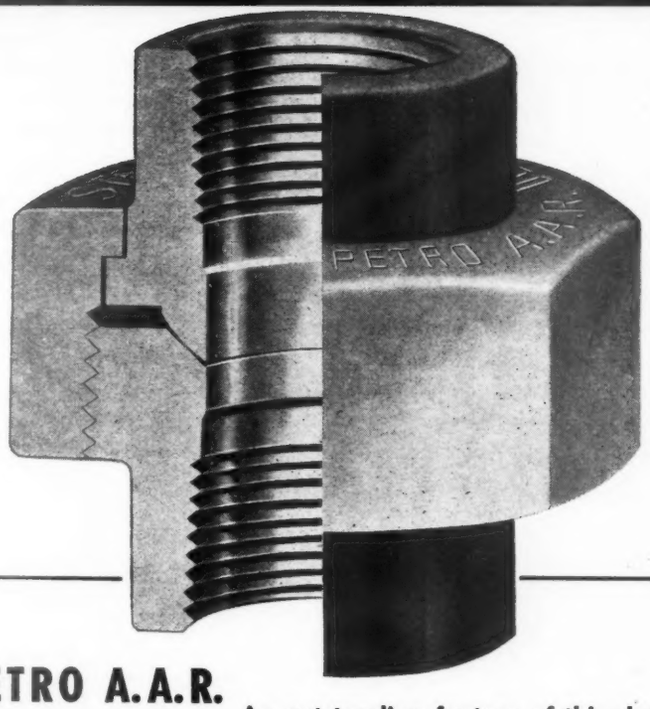

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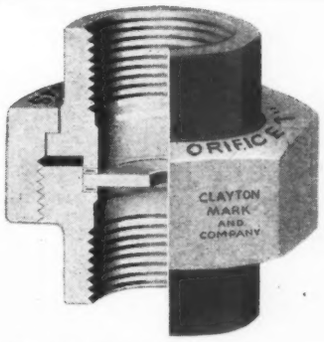

Write Dept. P for illustrated catalog or refer to listings in Composite Catalog pages 3140-3141, Refinery Catalog page 538, and Chemical Engineering Catalog pages 980-981.

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James F. Drake, Jr. has been appointed assistant to the vice president, product development and product engineering, for the Gulf Oil Corporation. Drake joined Gulf in 1937, collaborating in design and construction of special automotive engines and cars. In 1941 he attended Boeing School of Aeronautics and later became Eastern Air Lines representative at the Lockheed Aircraft Corporation. He rejoined Gulf as a lubrication engineer in 1948.

A. J. Singleton has been elected as a director of California Texas Oil Company, Limited, and of The Bahrein Petroleum Company Limited. Singleton, vice president of Caltex, was a director of the Petroleum Board in England during World War II, and has been engaged in the oil business since 1924. Beginning with Galena Signal Oil Company (of Ireland) Ltd., he subsequently became managing director of the English subsidiary of The Texas Company.

Drs. Donald S. Clark and **Pol Duwez,** associate professors of mechanical engineering at the California Institute of Technology, have been awarded the 23rd Charles B. Dudley Medal, highest award of the American Society for Testing Materials.

The award, presented at the 54th annual meeting of the society in Atlantic City, New Jersey, was established in 1926 for recognition of meritorious contribution to research in engineering materials. Drs. Clark and Duwez wrote on "The Influence of Strain Rate on Some Tensile Properties of Steel."

Clark, who joined the Caltech faculty in 1934, received his bachelor of science, master of science and doctor of philosophy degrees at the Institute. Duwez, who is chief of the materials section of Caltech's jet propulsion laboratory, has been on the staff since 1942. A native of Belgium, he received his doctorate at the University of Brussels.

Spring Golf Party. New York Nomads held their annual spring golf party at Siwanoy County Club in Bronxville recently. Out-of-town visitors included: Standing, George Cance, Socony-Vacuum Oil Company, Paris, France; Robert D. Morrison, California-Texas Oil, London, England; Jack S. Smith, International Cementers, Long Beach, California; Leslie Knowles, Drilling and Exploration, Buenos Aires, Argentina; Madden Works, Cameron Iron Works, Houston, Texas. Seated, M. E. Montrose, Hughes Tool; E. L. Lorehn, Cameron Iron Works; E. F. Hill, Gray Tool Company; Ralph Nehause, Cameron Iron Works; Paul Courtney, Emsco Derrick and Equipment, all of Houston, Texas, and Tom Crowley, The Petroleum Engineer, Dallas, Texas.

Harold C. Hose has been named assistant to executive vice president A. C. Long, of The Texas Company, and **H. H. Arnold, Jr.,** has been appointed manager of foreign operations (Eastern Hemisphere).

Hose has been with Texaco since 1927. He has held various positions in the refining department and has been associated with the company's foreign operations since 1944. Arnold also entered the company's service in 1927, in the geophysical department. Last November he was named assistant to the manager of the producing department at Houston. Both men will make their headquarters in New York.

Winners at the golf party in New York were: Low net scores—L. Horstman, Standard Oil Development, Linden, New Jersey, guest; Thomas N. Schults, Mid-Continent Supply Company, New York, winner of Frank Brown trophy, and William J. Campbell, Petroleum Machinery Corporation, New York, runner-up.

Low gross scorers were: G. R. Weeks, The Texas Company, runner-up, guest; John Evans, Lucey Export Corporation, winner, Nomad, both of New York; Harold Busold, Bill Foster Associates, Sparta, New Jersey, winner, guest, and E. F. Gahan, E. F. Gahan, Inc., New York, runner-up, Nomad.

LAUGH with BARNEY

Some years ago, a drilling crew had been working in an isolated location for days, subsisting on nothing but salt pork and hardtack.

Finally the men decided they needed a change of fare, so they sent one of their number on the long trip to town for a new supply of food. Eventually he returned—with 12 quarts of whiskey and one medium-sized loaf of bread.

As one man, the crew cried: "Now what the hell are we going to do with all that bread?"

* * *

A tourist was visiting a citrus grove belonging to a real old Southern Colonel in Florida and was impressed by a pet monkey that climbed trees and picked grapefruit. "Why don't you get a bunch of monkeys and train them to gather the fruit?" says the tourist. "If we did," says the Colonel, "the damned Yankees would want to free 'em!"

* * *

"Pop, I need an encyclopedia for school."

"Encyclopedia, hell; you can walk to school like I did!"

One sultry summer day an old judge was having lunch in a cafe when a friend stopped at his table. "You shouldn't be drinking hot coffee on a day like this, Judge," he cautioned. "Iced, stimulating drinks are much better for you in this sort of weather. Have you ever tried gin and ginger ale?"

"No, I haven't," snapped the judge, "but I've tried a number of people who have."

* * *

Two young women were visiting Rockefeller Center in New York. They were examining the statue of Prometheus, when one of them asked, "Who's that supposed to be?"

"Are you kidding?" rejoined the other. "Why, that's Promiscuous!"

* * *

A big game hunter has been missing for days. It is feared that something he disagreed with ate him.

* * *

Conscience: That still, small voice that tells you somebody's looking.

* * *

Secret of Success
Early to bed; early to rise;
Work like h—; and ADVERTISE.

A case was being heard in court in which a farmer was claiming indemnity for a cow killed by a railway train. Counsel for the defense put many tedious and superfluous questions.

"Was the cow on the track?" he asked the engineer.

The engineer had had about enough. He replied: "No, of course not. She was in a field half a mile away. But when it saw her, the engine left the rails, jumped the fence, and chased her across the field and up a tree. There it strangled her to death."

* * *

A problem child was becoming too well acquainted with the principal's office. One day the principal showed her annoyance. "This makes the fifth time I have punished you this week. What have you to say for yourself?"

"I'm glad it's Friday."

* * *

In 1770 the British Parliament passed a law against obtaining husbands by false pretense, that read as follows:

"That all women of whatever age, rank, profession, or degree, who shall after this act, impose upon, or seduce and betray into matrimony any of his majesty's male subjects, by virtue of scents, paints, cosmetics, artificial teeth, false hair, Spanish wool, iron stays, bolstered hips, or high heeled shoes, shall incur the penalty of the law now in force against witchcraft and like misdemeanors, and the marriage under such circumstances shall be null and void."

* * *

She was "Honey Chile" in New Orleans,
The hot spot of the bunch;
But on the old expense account,
She was gas, cigars, and lunch.

* * *

The only hotel in the town was crowded and the famous author on his lecture tour was installed in the bridal suite. When he left for the station, he forgot his umbrella. At the depot, he figured he just about had time to go back and get it. The room was locked when he got back there, however, and the lovey-dovey couple within were making no apparent effort to keep their romancing a secret.

"Whose 'ittle mouf is 'at?" cried the ecstatic groom. "Yours," sighed the bride. Smack! "Whose 'ittle neck is 'at?" "Yours, honeybun." Smack! Smack! "Whose 'ittle gweat big eyes?" "Yours, all yours." And so it went . . .

The author could take no more of it. He rattled the doorknob loudly and hollered, "Hey, you in there. When you get to an umbrella it's mine, all mine!"

OIL AND GAS TRADE NEWS

National Supply Offices Set Up in Calgary, Canada

Establishment of a department in Calgary to handle the sales accounting functions of the company in Canada, has been announced by R. Wesley Burns, division manager of The National Supply Company, Ltd. The operations had previously been conducted from Pittsburgh, Pennsylvania, where the company's principal accounting offices are. The expansion program in National Supply's Canadian office operations calls for doubling of office space, due to the tremendous growth of the oil industry throughout Alberta.

Houston Address Changed

The Houston office of Leeds and Northrup Company, Philadelphia, has been moved to 2480 Times Boulevard, Houston 5, Texas, from its former location, 1314 Texas Avenue. This new office provides 50 per cent more space, and better facilities.

Acquires New Plant

W. H. Hill, president of Baldwin-Hill Company, Trenton, New Jersey, has just announced the purchase of the Tex-Rock Insulation Manufacturing Company. He stated that the addition of the Texas plant to the three present Baldwin-Hill factories at Trenton, Kalamazoo, Michigan and Huntington, Indiana, was made to meet the rapidly growing demand for both industrial and domestic insulation materials throughout the Southwest.

New Ventura Branch

Art Moore and Ralph Ruse of Diamond Drilling Company, Long Beach 6, California, announce the opening of their new branch in Ventura. Situated at 1665 N. Ventura Avenue, the new office will be under the direct management of Jack Flanakin who has been operating with Diamond Drilling Company in the Los Angeles Basin area since the company's inception.

Hilliard Agents Named

The Hilliard Corporation announces the appointment of Guy T. Martin and Company, 642 East Olive Street, Gardena, California, as its representatives in this state to distribute its entire line of HILCO lubricating, fuel, and industrial oil purification equipment.

Annual Sales Meet

The annual sales meeting of the National Tank Company, held in Tulsa recently, was attended by engineers, managers, and salesmen. Highlighting the meeting was a discussion of National's first 25 years of service to the oil and gas industry and a presentation of service pins. Those receiving 25-year pins were: F. W. Baker, Merle Bryan, Jay P. Walker, Cecil G. Wells, and Joe Marshall.

Fifteen-year pins were awarded to: Spider Allen, Charles Purser, Lloyd Taylor and Joe Wells. Ten-year pins went to: Charles Lavery, Kenneth Shank, Wayne Snow, and Noel Webster at the annual meeting.

Waving to friends as they leave for a European business and pleasure trip, are John and Susan Merritt. Merritt is general manager of the Patterson-Ballagh Division of Byron Jackson Company. First stop is the PESA Convention in Quebec, Canada, and from there they will fly to London and the Continent where John will confer with British and French manufacturers who are licensees of Byron Jackson.

Illinois Plant Underway

Construction of new general offices and plant facilities of the Crane Packing Company of Chicago, Illinois, is underway. The new plant site, situated on Oakton Avenue near Lehigh in Morton Grove, Illinois, will cover 133,000 sq. ft. when completed. Crane manufactures industrial packings, mechanical seals, oil seals, etc.

Attending National Tank sales meeting are: Kneeling, Ed deYoung, Herb Walker, Bill Little, Charlie Purser, Bill Todd, Lynn Burrus, Reed Speir, Red Brinkley. Second row, Lloyd Conley, Neely Lowrie, George Steinhaus, Les Lamb, Dick Brooks, Sam Mays, George Powers, Johnny Shelton, Dud Lowrie, Ward Guin, Jack Godwin, Rex Williams, Tracy Smith, Jack Williams, Jim Tallant, Martin Smith, Sherman Barclay. Third row, Earl Keck, L. M. Jewett, Harold Jones, Bill Willis, Joe Wells, Merle Bryan, S. S. "Pete" Parker, Cliff Hill, Marvin Willis, Floyd Senter, Joe Marshall, Chester Immel, Jim Brown, Ed Fontaine. The meeting, attended by engineers, salesmen, and managers, was held in Tulsa.

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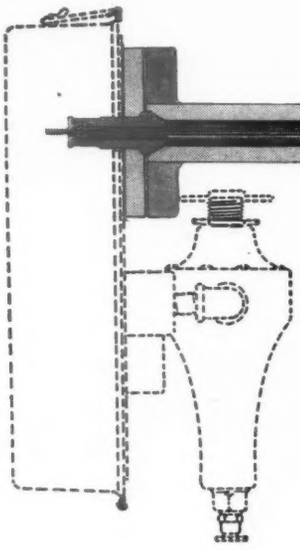

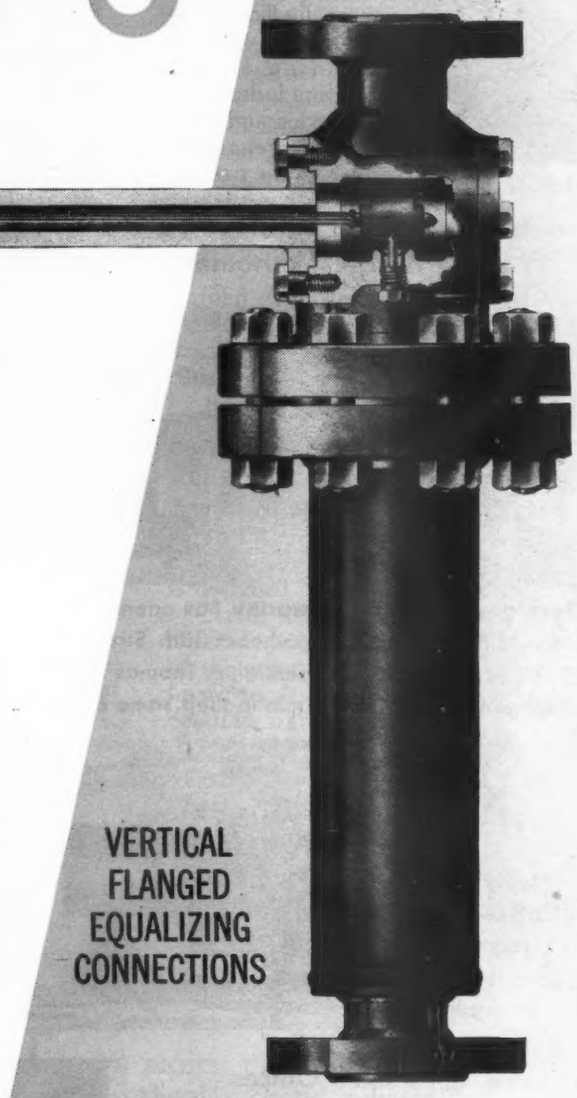

• Naturally, BS&B "Climax" would build this new Type 888 with more than 12 years' development and field testing behind it. Exclusive, patented features . . . integrated with versatile new ideas, have resulted in • New CONE POINT PIVOT, reduces bearing friction to minimum. It's rugged, friction-free and easily replaceable in the field • Torque tube housing is removable and reversible without special tools and without dismantling Controller housing • Reversible feature permits installation of two torque tube housings and two pilots and/or pilot and mercury switches. This means simultaneous liquid level control and alarm or emergency circuit operation • Smaller cage housing reduces weight, but heavier walls and flanges increase safety • All flange connections are male and female, assuring perfect alignment. Tighter connections with metal-clad gaskets • Obtain any combination of equalizing connections . . . vertical or horizontal or combinations of the two.

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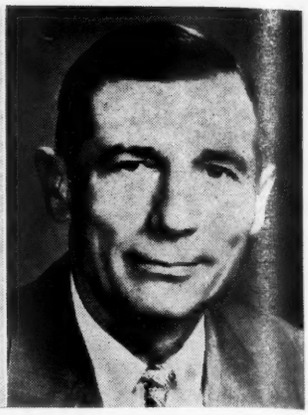
CONTROLS

Southwest Division Opened

Wall Colmonoy Corporation has announced the opening of its new office and warehouse, at 5815 Clinton Drive, Houston, Texas. Henry L. Howard has been appointed manager of this branch office. Howard received his training in the welding industry as a service and sales welding engineer. During the past six years he was on the staff of a large welding distributor in Texas as a sales engineer.

H. L. Howard



National Supply recently opened its newest store in San Angelo, Texas. J. Marcus Powell, who has been with the company for 27 years and in San Angelo for the past year and a half, has been named store manager.

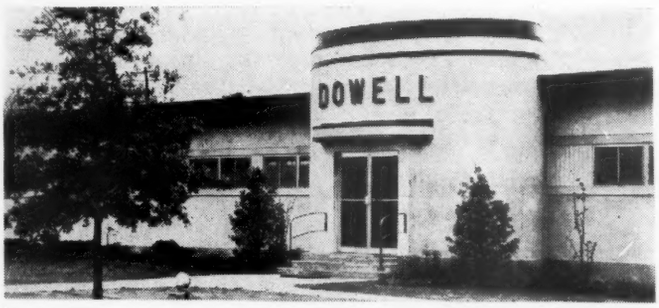
Bernlehem Supply Company has opened its second Oklahoma City supply store. Situated at 601 Southeast 30th Street, the store is managed by F. C. (Fred) Beattie, field representative. Thomas Ray and B. C. (Slim) Urquhart, field representatives, will continue in their same capacities.

Cummins Opens Diesel Shop

Cummins Sales and Service, Inc., operating 10 diesel service shops in the Southwest, has announced the opening of its eleventh shop at Pharr, Texas. J. E. Everroad, president of the company, in an announcement on the opening of operations in the valley stated that because of the numerous Cummins diesel engines operating in and around the area the company had chosen Pharr as a base for its operations because of the city's important location.

Cleco Names Norway Agent

The Cleco Division of Reed Roller Bit Company, Houston, Texas, has announced the appointment of Sigurd Stave, Kengensgate 10, Oslo, Norway, as distributor for Cleco products in that area. Cleco manufactures the "Cleco" and "Dallett" lines of air tools and accessories—including tools for construction, manufacturing, metal fabrication, foundries, industrial maintenance and stone carving.



Newly opened office building recently built by Dowell Incorporated.

Dowell Completes Offices

A new, modern office building has been constructed at 1150 North Utica Avenue, Tulsa, Oklahoma, by Dowell Incorporated, a wholly-owned subsidiary of The Dow Chemical Company.

Also situated at 1150 North Utica Avenue are Dowell's truck, magnesium anode, and chemical manufacturing plants, the warehouse and the engineering research laboratories.

The exterior and the floors of the building are finished with a new cementatious material now manufactured by The Dow Checical Company in their Freeport, Texas, plant. Like Dowell's magnesium anodes for cathodic protection, the new cement is manufactured from sea water. The new cement, known as Oxyment, is a magnesium oxychloride cement — a combination of magnesium chloride and plastic oxychloric.

Three Rolo Manufacturing Company employees received promotions at a recent meeting. They are: James L. Kepple, named assistant general manager; H. Vernon Smith, general manager; R. K. (Bob) Franklin, founder; W. M. Boren, made chief engineer, and R. G. Oliphant, assistant chief engineer.

Perspective sketch of new plant planned by Rockwell Manufacturing Company in Tupelo, Mississippi. It is a one-story building and covers 150,000 sq ft.

H. M. Harper Expands Plant

Construction of a new addition to the plant of The H. M. Harper Company, Morton Grove, Illinois, manufacturer of non-ferrous and stainless steel fastenings, was recently begun. Scheduled for completion late this year, the new building will increase total floor space to 166,000 sq. ft. When completed, the addition will house complete facilities for the reduction of copper, nickel, aluminum, and stainless steel wire and bar stock.

Expansion Program Complete

Aeroquip Corporation of Jackson, Michigan has completed its extensive expansion program with completion of its Burbank, California, plant. The Burbank plant, situated in the heart of the West Coast aircraft industry, is operated by Aero-Coupling Corporation, an Aeroquip subsidiary. Other expansion moves recently completed include the addition of a new 65,000 sq. ft. building to Aeroquip's main plant in Jackson, and the acquisition of another subsidiary, Metalco, Inc., with a plant in Cheboygan, Michigan.

Beecroft Is Distributor

G. W. Beecroft and Company, Toronto, Canada, has been named sales representatives for the Province of Ontario for Chiksan Company, Brea, California. G. W. Beecroft, a professional engineer, was associated with Imperial Oil Company for many years. Sociedade Commercial de Materias Primas Ltda., Rio de Janeiro, Brazil, have been named representatives in that country.

O-C-T to Produce Steel Ring Gaskets

Oil Center Tool Company has begun commercial production of API steel ring gaskets in its Houston, Texas, plant. Prior to the recent expansion of the ring gasket division, Oil Center Tool's entire output was used in the manufacture of its own equipment for the oil industry. A complete size range of API ring gaskets will be manufactured by Oil Center Tool Company, and they will be distributed through oil field supply stores and other industrial distribution outlets.

Memorial Award Founded

John A. Carter, president of Oakite Products, Inc., manufacturers of industrial cleaning and related materials, has announced the establishment by the Company of the David C. Ball Award for Distinguished Service, a bronze plaque to be presented annually to the member of the Oakite technical field organization who has rendered the most outstanding service to industry during the year. The award is designed to perpetuate the memory of David Clifton Ball, pioneer in industrial cleaning procedures, founder of the company and chairman of its board of directors at the time of his death in March of this year.

NEW... 300 G.P.M. COMPACT

For Petroleum, Process and General Industries

ROPER 3600 HBRV No. 7 PUMP

Highly efficient venturi suction and discharge principle for smooth flow; deep packing box with lantern ring for effective sealing and long packing life. Case can be fitted for steam heated operation at small extra cost. Ideal for thick viscous liquids. Driven by gasoline engine, geared head motor or power take-off for wide range of applications.

Capacity, 300 G.P.M.

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728 Blackhawk Park Avenue
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Renew Old Drums in Just 7 Minutes!

THAT'S RIGHT! Used drums restored to like-new condition . . . cleaned, paint-stripped, rinsed, dried, and repainted . . . in just 7 minutes! That's how fast Oakite cleaning works in one barrel-house.

Oakite cleaning has three other advantages, too: Fewer rejects . . . more uniform paint stripping . . . better adhesion for new paint. No paint build-up on steam coils . . . no clogging of drains and sewers.

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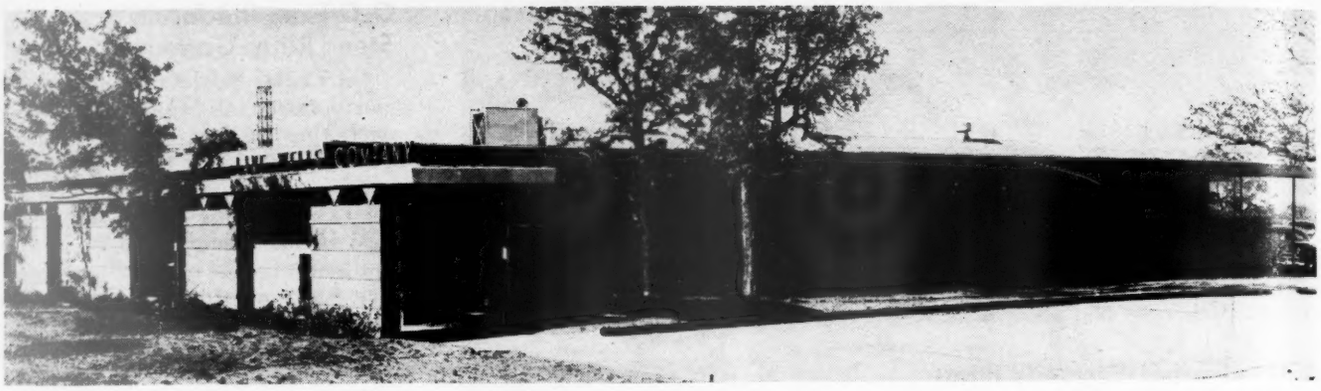


Lane-Wells Company's new offices in Oklahoma City. Formerly at Apco Tower in Oklahoma City, Lane-Wells offices now occupy the newly constructed building at 5800 North Eastern, at the same location as the Lane-Wells shop. The new building, of contemporary design, features a large parking area and other customer facilities.

Badger, Stone & Webster Combine Process Facilities

Activities formerly engaged in by E. B. Badger and Sons Company and Stone and Webster Engineering Corporation's process division will be carried on hereafter by the Badger process division of Stone and Webster Engineering Corporation, it was recently announced. These activities consist of engineering and construction services in the chemical, petrochemical, petroleum fields, etc.

Erastus B. Badger, who has been president of Badger and Sons, has been elected a director of Stone and Webster, and Ralph D. Waterman, formerly vice president of the Badger Company, has become a vice president of Stone and Webster.

National Supply Sets Up Two Sales Divisions

National Supply Company has announced the creation of two sales divisions with headquarters in Houston and Fort Worth, Texas. The Southwest division, headquarters at Fort Worth, consists of the 20 stores operated by the company in an area comprising northern Louisiana, southern Arkansas, East Texas, West Texas, New Mexico. James M. Thompson is division manager.

J. M. Thompson

J. W. Babb

The Gulf Coast division, with headquarters in Houston, will be under the management of John W. Babb and will be comprised of the 15 stores in Mississippi, Southern Louisiana, and the entire Gulf Coast region.

Colorado Store Opened

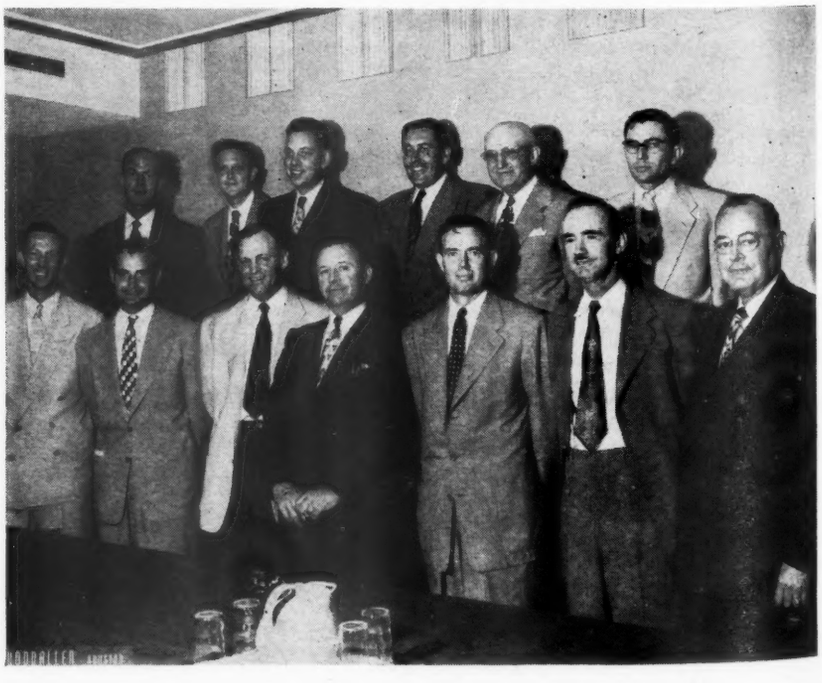
Bethlehem Supply Company has opened a new store at Sterling, Colorado. Location is in the east portion of the Sterling Ice and Cold Storage Company Building, at South Third Avenue and Hamilton Street. A representative stock of oil country equipment and supplies will be available. B. C. Bayless, formerly assistant store manager at Casper, Wyoming, has been appointed store manager and field representative.

B. C. Bayless

Huge Expansion Planned

Investment of a million and a half dollars in a construction program covering new erection floor, expansion of present test facilities, manufacturing space, and machine tools by Roots-Connersville Blower Corporation, Connersville, Indiana, has been announced. These new facilities will enable Roots-Connersville to test the largest centrifugal blowers and compressors ever designed, which it is now building. Roots-Connersville has specialized in the design and construction of industrial and specialized blowers for more than 100 years, and is now completing a large contract covering a 10-unit order of centrifugal compressors requiring 53,000 hp.

Thornhill-Craver Company, Houston, held its annual sales meeting in Houston recently. Seen at the meeting are: Back row, Frank Baker, W. J. Hill, L. F. Helton, Clint R. Horn, Walter A. Hammann, and J. C. Hembree. Front row, M. E. Moore, T. J. Billings, H. E. Thornhill, Earl Grissom, Bert Griffin, J. E. Loeffler, and Kenneth Craver. Representatives were entertained in Galveston.



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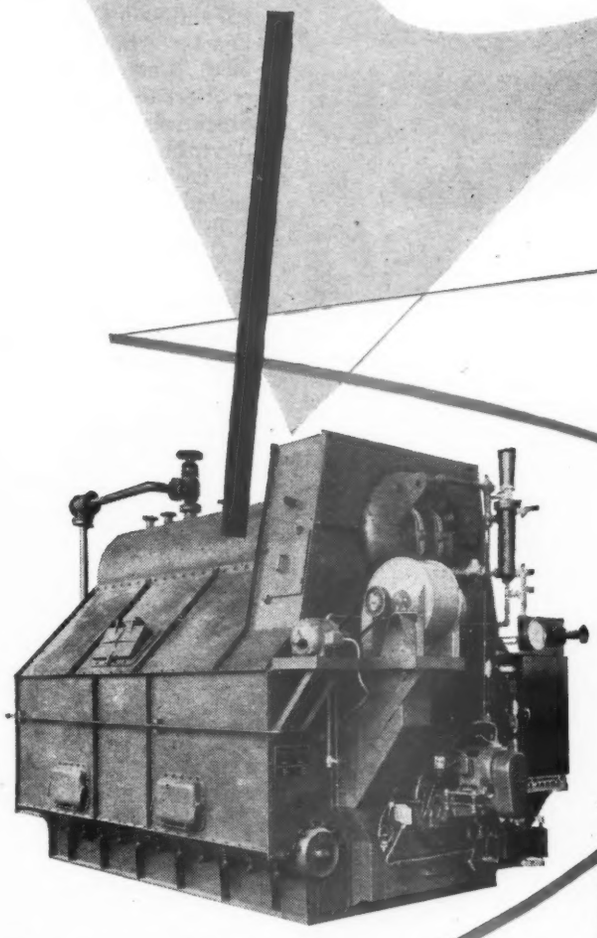
TO PRODUCE THE STEAM
YOU NEED



Wickes shop-assembled Steam generator

Wherever you are, whatever your steam generating needs may be, there's a custom-built Wickes boiler to suit your operation. For almost a century now, The Wickes Boiler Company has been leading the field in the manufacture of high-pressure boilers. Throughout the world, industries and institutions that depend on steam have learned by long experience that they can depend on Wickes. Wickes Boilers operate at a high degree of efficiency and owners' records show very modest maintenance costs. Wickes can fill your requirements for steam generators up to 250,000 lbs. per hour and 850 lbs. per square inch . . . all types of multiple drum boilers adaptable to any standard method of firing. Contact your nearest Wickes representative or write to our home office.

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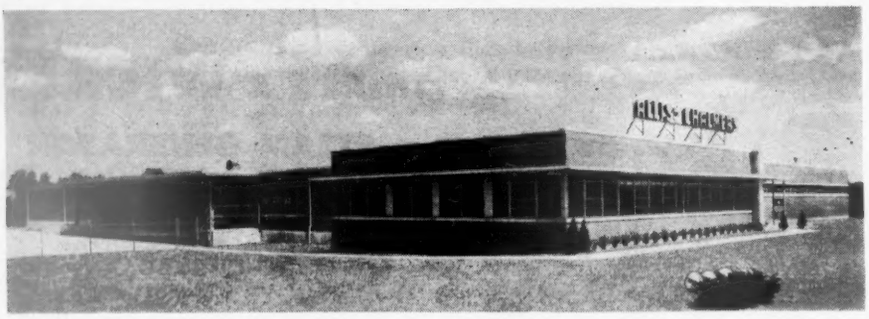
RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: • Atlanta • Boston • Chicago • Cincinnati • Denver • Detroit • Houston • Indianapolis • Los Angeles • Milwaukee • New York City • Pittsburgh • Saginaw • San Francisco • San Jose • Springfield • Seattle • St. Louis • Tulsa • Mexico City • Buenos Aires • Manila • Havana • Montevideo • San Juan, P. R. • Victoria, B. C.

Completes Louisiana Store

The National Supply Company has installed new facilities at Shreveport, Louisiana, to replace the company's store, which has operated there since 1910. New facilities will service the North Louisiana, East Texas, and South Arkansas area. The new store is easily accessible and large enough to take care of the needs of operators in the area. It includes a sales room, both store and district offices, and a warehouse. The store will be managed by R. E. Brook.

National Supply's new store in Shreveport, Louisiana.



New Allis-Chalmers' factory branch in Atlanta, Georgia.

Dresser Equipment Company Formation Is Announced

Completion of the formation of a new organization known as Dresser Equipment Company is announced by H. N. Mallon, president of Dresser Industries, Inc., Dallas, Texas. The new company is composed of two former Dresser Industries' subsidiaries, Kobe, Inc., developers and manufacturers of Kobe hydraulic oilwell pumping equipment, and International Derrick and Equipment Company, manufacturers of oilwell drilling and production equipment. These two organizations will function as the Kobe Division and Ideco Division of Dresser Equipment Company.

Kobe will be a complete operating unit. Ideco will operate its three manufacturing plants at Columbus, Ohio, Beaumont, Texas, and Torrance, California, as separate units under their own general managers, who will report directly to John B. O'Connor, recently named president of Dresser Equipment Company, and vice president of Dresser Industries, Inc.

W. C. Norris, Manufacturer, Inc. held its fifth annual sales conference in Tulsa, Oklahoma recently. Management, engineering, production, and sales executives participated in the meeting. Present were: Seated, Jack C. Schaff, Wichita Falls, Texas; Arthur Miller, Jr., assistant sales manager; G. W. Davidson, sales manager; M. L. Parker, Odessa, Texas; LeRoy Mitchell, Casper, Wyoming; Jack Getty, Shreveport, Louisiana; A. L. Ethriedge, Oklahoma City; R. A. Colgin, vice president in charge of plant operations; S. A. McGill, Odessa. Standing, C. B. Schofield, Tulsa; J. E. Giles, North Oklahoma and East Kansas; D. W. Stewart, Midland; D. P. Hagaman, Salem, Illinois; J. H. Coman, manager, material control, Tulsa; Edward C. Bolger, president; W. J. Whitaker, Fort Worth; A. A. Hardy, chief engineer, Tulsa; J. W. Bowen, Houston; W. C. Tolleson, Kilgore; C. T. Fair, Great Bend, Kansas; W. L. Butler, executive vice president; C. L. Snelling, Tulsa; K. M. Cook, Abilene.

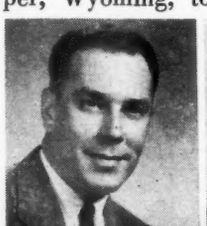
Allis-Chalmers' Opens New Atlanta Branch Building

Allis-Chalmers' has opened a new, streamlined factory branch at 4646 Peachtree Boulevard, Atlanta (Chamblee), Georgia. More than 350 dealers, territory salesmen, and company executives viewed the new facilities at the formal opening recently.

The new 8-acre property was designed for the use of fork lift trucks, and a conveyor system speeds the packaging of repair parts.

Wyoming Office Opened

Magnet Cove Barium Corporation has opened a new district office in Casper, Wyoming, to serve the Rocky Mountain region. C. W. Clark, Jr., has been appointed manager of the Rocky Mountain division.



C. W. Clark

J. H. McLaurin

J. T. Webster

Other new appointments announced by the company are Joe T. Webster, manager of the Texas Gulf Coast division with offices in Houston and James H. McLaurin, manager of the Southeastern division with offices in New Orleans.

Lane-Wells Truck Station

Lane-Wells Company has established a truck station at Luling, Texas. Lewis W. Hunt, who was formerly an operator at Corpus Christi is operator-in-charge of the new station, which is situated on Houston Highway. This new branch will facilitate Lane-Wells in rendering perforating and radioactivity well logging services.

TRADE PERSONALS

L. T. Wold

C. J. Coberly

L. T. Wold has been elected vice president of Dresser Equipment Company and has been named general manager of the company's Kobe, Inc., division. Wold joined Kobe as controller in 1946. **C. J. Coberly,** founder of Kobe, Inc., has been relieved from many of the general administrative duties. He will retain his position as vice president of Dresser Equipment but will be free to devote most of his time to organizing and directing a new product research and development department of Kobe, Inc.

Donald F. Greenlaw, Oil Well Supply Company, formerly manager of the Victoria, Texas, store, is transferred to Alice, Texas as assistant to district merchandise manager. He is succeeded by **Edward D. Haas,** manager of the Mirando City, Texas store. The new manager of the Mirando City store is **Joseph P. Higgins,** field representative at Freer, Texas for the past year. **Rush L. Johnson,** storeman at Alice, has been promoted to field representative at that city.

W. H. Petross

H. Parrish

W. H. (Pete) Petross and **Harlan Parrish,** have joined the field staff of Oil Base, Inc., manufacturers of Black Magic, White Magic, and oil base mud conditioners. These men will be stationed in West Texas, with Petross at Odessa, in charge of the area, and Parrish at Midland. Prior to his association with Oil Base, Inc., Petross was co-owner of Walker Oil Well Specialties, Inc., in Oklahoma City. Parrish, a graduate of Oklahoma City University, was formerly with Santa Fe Drilling.

I. F. Thomas has been appointed manager of the newly established western district office of the S. S. White Industrial Division. He will be situated in the Times Building, Long Beach, California. Thomas will handle all activities in connection with S. S. White flexible shafts, resistors, valves for compressed gases, plastic products and aircraft accessories in the northwestern, southwestern and far western states. He is a graduate of M.I.T.

T. D. (HI) Collins has been named vice president and general manager of Iverson Supply Company. Widely known throughout the oil industry, Collins is a veteran of more than 20 years in the oil field supply business. He was formerly vice president of the Ideco Supply Store Division and a member of the board of directors.

T. D. Collins

James D. Hughes, general sales manager of Lane-Wells Company has been elected a director of Lane-Wells to fill a vacancy on the board. Hughes has been associated with Lane - Wells since 1939 and was Gulf Coast division sales manager of the company in Houston from 1941 to 1945 when he was transferred to Los Angeles as manager of oil field sales. Early in 1945 he was made sales manager.

J. D. Hughes

Gordon L. Chapman was elected president of the Carver Pump Company, Muscatine, Iowa, and **Roy J. Carver,** founder of the company, was elevated to chairman of the board. Chapman joined the company in 1948 as comptroller. In July of that year, he was elected vice-president and a director.

He is a graduate of Illinois University.

The company also announced the election of **Alexander A. Zuber,** plant manager as a vice president and a director. Zuber was graduated from Illinois Institute of Technology.

W. J. Gillingham

A. Claudet

W. J. Gillingham, an employee since 1934, has been appointed executive vice president of the Schlumberger Well Surveying Corporation. He will replace **Roger Henquet,** who recently resigned from the organization. **A. Vennema,** a graduate of the University of Michigan, has been promoted to the newly created position of vice president in charge of personnel relations. **A. Claudet** will replace Gillingham in Caracas, Venezuela, where he has been appointed vice president and general manager of the Schlumberger companies operating in South America. **Charles Doh** is being transferred from Illinois to New Orleans, where he will replace Claudet as manager of the southeast area. **Allen Morazzani** has been promoted to the position of manager of the northeast area (Illinois, Kentucky, Michigan, and Appalachian region), in turn, replacing Doh.

George Stoddard has been appointed sales engineer for Western Directional Drilling Company, Long Beach, California. Stoddard is well known to California oil and equipment men and joins the company with a wealth of experience and "know how" about California drilling conditions. His headquarters will be in Long Beach.

H. C. Hill

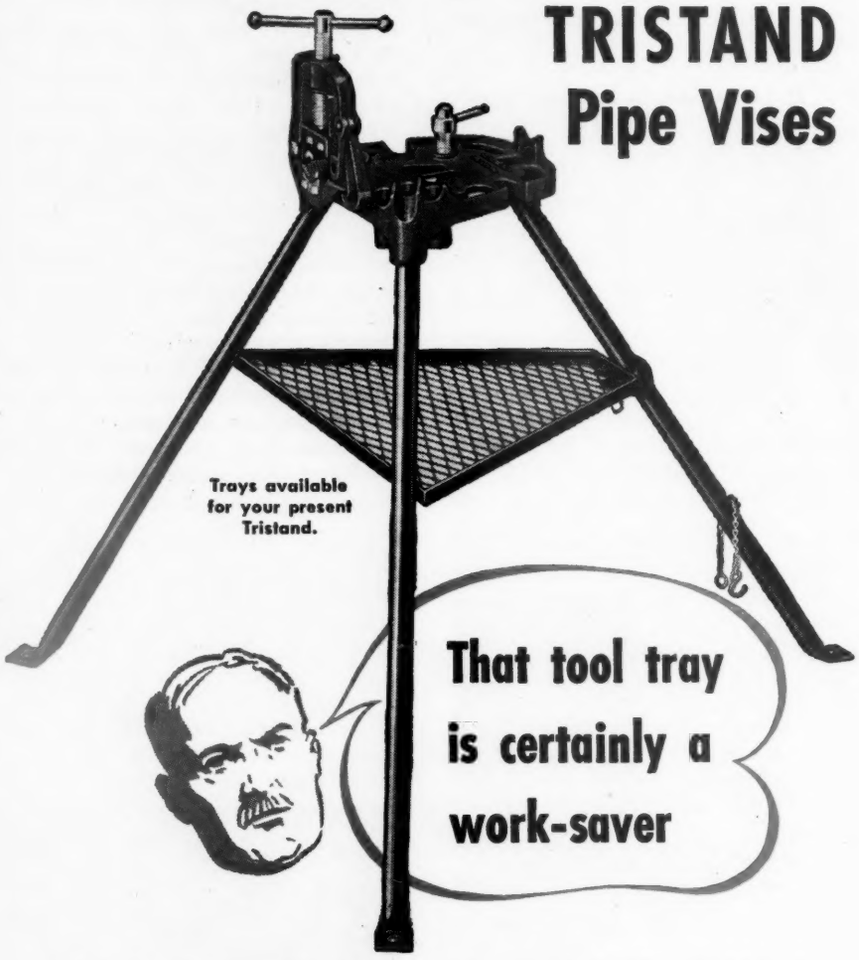
C. L. Pringle

Harry C. Hill, Dallas, Texas, has been appointed by Motorola, Inc., to serve with **Chester L. Pringle** of Fort Worth, as marketing specialist for Motorola industrial control products. Pringle, who has been serving as marketing specialist since 1951, has been zone manager for Motorola's V.H.F. mobile communications operations in west Texas and New Mexico since 1946.

Hill has been president of Engineering Products Corporation of Dallas since 1947.

Handy work bench is a Bonus!

WITH RIDGID TRISTAND Pipe Vises



● It's right there when you need it—the handy workbench built into every Tristand. New tray keeps tools at your fingertips—less stooping, easier work. Tray makes Tristand rigid—won't fold up in use. Legs have rubber feet to prevent travel. LonGrip tool-steel jaws won't slip, won't mar polished pipe and tubing. Yoke vise, 2½" capacity; chain vise, 4". Buy these new work-saver RIDGID Tristands at your Supply House.

RIDGID

★ Work-Saver Pipe Tools ★

THE RIDGE TOOL CO. • ELYRIA, OHIO

T. H. Roberts R. W. Allen

▸ **R. W. Allen** was named district manager of Mack Motor Truck Corporation's St. Louis, Missouri branch. Allen, who joined Mack in 1926, has been manager of the Mack Houston branch for the last 10 years.

T. H. Roberts has been named sales manager of Mack's Dallas, Texas, branch. With Mack since 1948, Roberts is former wholesale manager for the Dallas branch.

▸ **L. G. (Les) Evans** has been appointed plant manager of the Garland, Texas, plant of the D+B Division, Emsco Derrick and Equipment Company. He fills the position left vacant by the recent retirement of **Frank L. Prosser.** Evans, a graduate of the University of Southern California, joined D+B in 1940, when he became storeman and sales trainee at the company's Long Beach, California, store. He was transferred to Garland as chief engineer last year.

L. G. Evans

▸ **Dr. B. F. Daubert,** research administrator and professor in the chemistry department of the University of Pittsburgh since 1943, has joined the research department of Koppers Company, Inc., as assistant manager of the laboratory section. Daubert, who is widely known as a chemist and an administrator, has written more than 70 articles in chemical magazines. He was graduated from the University of Pittsburgh School of Pharmacy.

▸ **John L. Wilson,** vice president and director of Anheuser-Busch, Inc., has been elected a director of Mack Trucks, Inc. Wilson was previously long associated with Mack and joined the organization in 1922 immediately after leaving Wittenberg College at Springfield, Ohio. After spending 22 years with Mack, he joined the St. Louis Public Service Company as president.

J. L. Wilson

CORROSION CRIPPLES-
MORE WAYS THAN ONE

Valuable products as well as vital equipment are threatened

Corrosion takes its toll in more ways than one—it eats away costly, hard-to-get equipment—wastes man-hours while plants are shut down for repairs—and causes loss of vitally-needed products through contamination.

Every industry suffers from corrosion in some form, yet much of this waste can be avoided by taking these steps:

1. Check manufacturing equipment, storage tanks, and other items exposed to corrosive fumes, acids, alkalies, or moisture.
2. Arrange to protect them with AMERCOAT — the corrosion resistant coatings, each built to conquer specific industrial corrosion problems.

Manufacturers in nearly every industry have found that it pays to protect — protect with AMERCOAT.

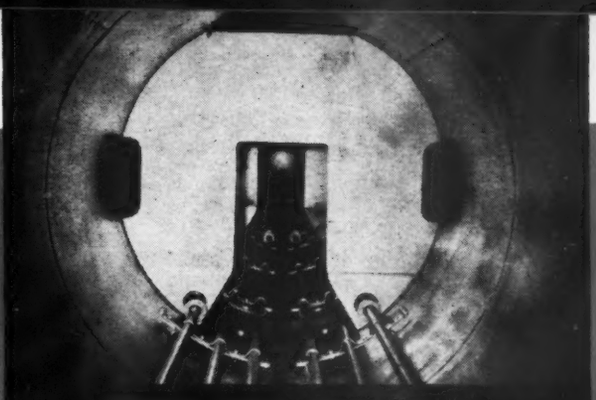
AMERCOAT CORPORATION

A division of
American Pipe and Construction Co.

4809 FIRESTONE BLVD., SOUTH GATE, CALIFORNIA

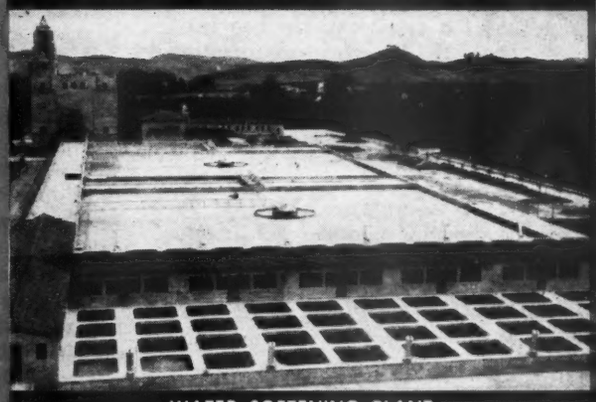
FOLLOW THE LINE OF most RESISTANCE

2-51-I

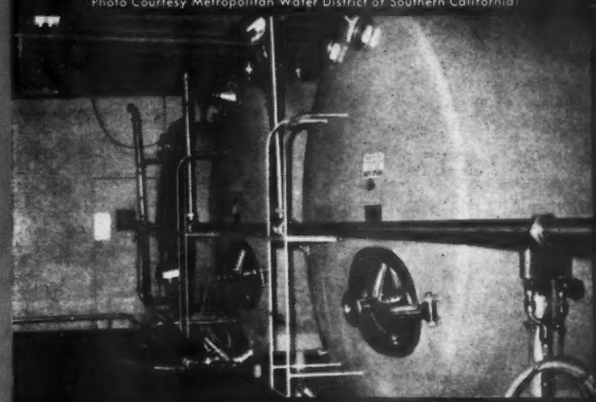


CHEMICAL PLANTS — Caustic Soda Tank

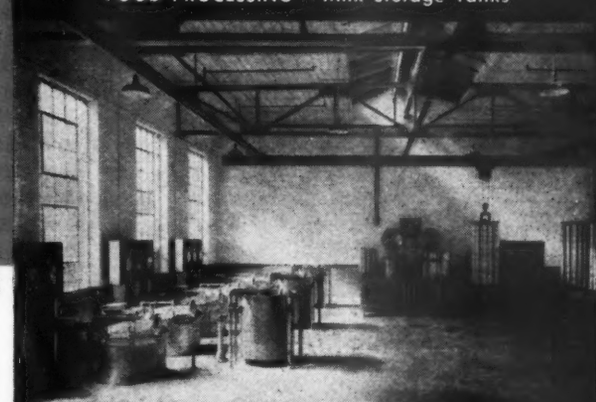
PETROLEUM REFINING — Columns and Piping



WATER SOFTENING PLANT
Photo Courtesy Metropolitan Water District of Southern California



FOOD PROCESSING — Milk Storage Tanks



TEXTILE MILLS — Dyeing and Finishing

▸ **L. E. Menns** has been named Pacific Coast sales manager of Bridgeport Brass Company. He will be in charge of the San Francisco district office and warehouse, responsible for the sale of all Bridgeport products on the Pacific Coast, as well as continuing in the capacity of Los Angeles district manager.

The company announced it was consolidating the sales activities of the Los Angeles and San Francisco offices and warehouses to give customers in this area improved service.

▸ **Foster A. Jordan** has been appointed assistant sales manager of Well Equipment Manufacturing Corporation, Houston, Texas succeeding **John W. Gates,** who has been made sales manager. For the past year Jordan has been representing the company in the West Texas-New Mexico territory. He has been with the WECO sales organization for the past 6 years. **J. C. McCelvey** and **L. L. Durkin** are being transferred to West Texas-New Mexico territory as representatives.

F. A. Jordan

▸ **Arch J. Cochrane** has been appointed assistant manager of Chicago, Illinois, district operations for The Youngstown Sheet and Tube Company. Cochrane has been in the steel business more than 25 years, in line and executive positions. He will assist **B. M. Stubblefield.**

▸ **Otto von Perbandt** has been named representative in the Ohio territory, for Bigelow-Liptak Corporation, Detroit, Michigan. Von Perbandt will represent the company in Southern Ohio, part of Indiana, and Kentucky. He will work out of his office at 305 Schwartz Building, 906 Main Street, Cincinnati.

▸ **Dr. H. W. Fleming** has joined the research and development department of The Girdler Corporation, Louisville, Kentucky. He will direct the company's expanding catalyst development program. Dr. Fleming received his Ph.D. degree from Western Reserve University. Before his association with Girdler he was a group leader in the Phillips Petroleum Company's research and development department.

H. W. Fleming

A. V. Baber H. E. Casey E. C. Shuman W. R. Lugar P. W. Boyd

▸ **A. V. Baber, H. E. Casey, E. C. Shuman, W. R. Lugar,** and **P. W. Boyd,** Kaylo Division of Owens-Illinois Glass Company, Toledo, Ohio, have all been promoted in a sales department expansion move. Baber has been made manager, heat insulation sales. A civil engineer, he has been with Owens-Illinois since 1943.

Casey now has the responsibility for sales of Kaylo insulating roof tile and laminated products, with the title, manager, structural product sales. Also a civil engineer, he has been with Owens-Illinois since 1942. Boyd, who joined Owens-Illinois early in 1951, has been given the new post of supervisor of laminated products, which include Kaylo firedoors and Kaylo C-A panels. Continuing as supervisor of roof tile sales is **T. F. Sears,** who reports to Casey.

Shuman has the titles of director of research and manager of product development. Accelerated programs are planned for both of these functions. Lugar also carries two titles, that of general branch manager having been added to his previous title, manager of sales control. His responsibilities have been increased. He came to Owens-Illinois in 1941.

D. C. Wiley A. E. Weingard

▸ **Donald C. Wiley** has been appointed vice president in charge of research of American Meter Company, makers of precision instruments for the measurement and control of gas, air, steam, oil, and other fluids. Wiley was graduated from Purdue University in 1931. He became associated with American Meter in 1947. The company has also announced the appointment of **Archie E. Weingard** as vice president in charge of production.

Weingard joined American Meter in 1947 as supervisor of methods. He is a graduate of the General Electric technical engineering school.

▸ **Byron Stoothoff** has been named division manager in Division 600 of the Cleco Division, Reed Roller Bit Company, Houston. He will make his headquarters in Cincinnati, Ohio.

▸ **Kenneth S. Thomson,** presently executive secretary of the Cleveland Association of Credit Men, was elected president of the Sterling Engine Company, Buffalo, New York. Born in Scotland, Thomson came to the United States 35 years ago and made his home in California.

K. S. Thomson

He will resign his executive position with the Cleveland Association of Credit Men at once to assume his new duties with Sterling.

Leslie D. Calhoun will become vice president in charge of engineering. **Harold W. Burkett** will continue as secretary and treasurer of the company. Both men have been with Sterling for some time past.

▸ **Robert J. Greenwell** was appointed as manager of the Kansas City office of Sample Brothers, distributors of industrial equipment. Greenwell, a graduate of Kansas University, was formerly with the American Locomotive Company. Sample Brothers are sales representatives for a dozen companies, including the Burgess-Manning Company, of Libertyville, Illinois, manufacturers of industrial noise abating equipment.

▸ **Wallace R. MacGregor,** formerly common-carrier engineer on the staff of Federal Communications Commission has joined Lenkurt Electric Sales Company as manager of government sales for carrier telephone and telegraph systems. He will head two new branch offices in Washington, D. C. and Monmouth County, New Jersey (serving the Signal Corps at Ft. Monmouth). He is a graduate of Clarkson College of Technology.

W. R. MacGregor

▸ **Edward H. Roper** has been named manager of the general technical sales department of Air Reduction Sales Company, a division of Air Reduction Company, Inc. Joining Air Reduction in 1936, Roper served in various capacities in the general technical sales department and was appointed assistant to the manager of that department in 1944. Four years later he became assistant manager of this department whose function it is to assist users of Airco products in their proper applications.

▸ **L. H. (Harley) Bowen,** formerly in charge of sub-surface sales for Republic Supply Company, has been appointed Mid-Continent area representative for Agate Corporation. He will be responsible for development of Agate filter sales and service in the Mid-Continent and will make his headquarters in Houston, Texas. Before joning Republic Supply Company in 1946, Bowen represented pump companies in Texas, Oklahoma, Kansas, Illinois, and Indiana and is familiar with many of the production problems in these areas.

▸ **R. H. Campbell,** formerly purchasing agent and traffic manager for the Dallas Tank Company, has been named purchasing agent and traffic manager of Burgess-Manning Company. **W. C. Jack,** also a former Dallas Tank Company man, has been appointed design engineer for Burgess-Manning. R. T. Oliver was named sales correspondent to assist in the facilitating of field operations.

▸ **Thomas G. Simison** was appointed division superintendent of rolling mills connected with the making of tin-plate and flat rolled products at Kaiser Steel Corporation. Simison, a resident of Ontario, has been with the company since October 1948 and was formerly assistant superintendent in the merchant mill. Continuing as division superintendent of rolling mills is **Robert C. Madden,** who will be responsible for the operation and production of all mills rolling structural, merchant and tubular products.

Appointments to four other key positions in the management of Kaiser Steel's new tin plate mill were also announced. Named as assistant superintendents to William Keirn were **Dale Miller,** formerly assistant superintendent of cold rolling at Kaiser Steel; **Harry Reading** from Weirton Steel, West Virginia, and **Walter Dettman** from Youngstown Sheet and Tube, Ohio.

Roger Barnes, formerly foreman at the Sparrow's Point, Maryland, tin mill of Bethlehem Steel, has been engaged as general foreman of the new Kaiser tin mill. It was further announced that **Reynold C. McDonald** will succeed Thomas Simison as assistant superintendent of the merchant mill and that **Joseph Lencioni** has been appointed assistant superintendent of cold rolling in place of Dale Miller.

▸ **John C. Diehl** has been named chairman of the board, American Meter Company, Inc. Diehl is a graduate of the Massachusetts Institute of Technology. In August of 1950, he became president of American Meter, a position that he held until his recent election to chairman of the board of directors.

J. C. Diehl

▸ **William J. Thomas,** general sales manager of The Babcock and Wilcox Tube Company, has been named to the tubing industry advisory committee, which functions under the Office of Price Stabilization. Thomas has also been named to the welded and seamless steel tubing industry advisory committee, which functions under the Iron and Steel Division of the National Production Authority.

▸ **George A. Bulmer** has been named manager of the newly formed west coast branch of the Insul-Mastic Corporation of America. His headquarters will be in Los Angeles. Insul-Mastic manufactures protective coatings for the prevention of corrosion in industry. Bulmer will cover the states of Oregon, Washington, Nevada, Utah, California, Arizona, New Mexico, Colorado, Wyoming, Idaho, and Montana for Insul-Mastic.

▸ **Ben King Duffy,** sales engineer, General American Transportation, has been appointed district sales manager of the plate and welding division for the Pittsburgh, Pennsylvania district. His territory includes the western half of Pennsylvania, eastern half of Kentucky and Ohio, West Virginia, and Tennessee.

▸ **Roger Henquet,** executive vice president of Schlumberger Well Surveying Corporation, has resigned after 22 years. He was one of the original group of young French engineers who helped build the corporation from a small geophysical unit into a world-wide organization.

Henquet first worked in the United States in 1929. He was transferred to Roumania, and in 1933 he returned to the U. S. and established Schlumberger operations in California. In 1945 he became executive vice president of Schlumberger.

▸ **F. E. Prosser,** Continental Supply Company, former field salesman at Liberal, Kansas, has been appointed store manager at the same location. **J. A. Vogle,** former Continental store manager at Liberal, has been transferred to Ellinwood, Kansas, in the same capacity. Both stores are under the direct supervision of **R. O. Hambric,** assistant district manager, Wichita, Kansas.

▸ **Charles P. Harlow** was named sales manager of the hardware products department, of the Wickwire Spencer Steel Division of The Colorado Fuel and Iron Corporation. In 1936 he joined the then Wickwire Spencer Steel Company. His most recent position was that of assistant district sales manager in the Boston office. Harlow succeeds **William Sewert** who has resigned. Harlow and **William Kempton,** assistant hardware products sales manager, will continue to be in the new sales office of the hardware products department at the corporation's subsidiary, American Wire Fabrics Corporation, Mt. Wolf, Pennsylvania.

▸ **Yale W. Titterington,** formerly with the Dow Chemical Company and its subsidiary, Dowell, Inc., for 9 years, has been appointed vice president in charge of sales for Standard Magnesium Corporation of Tulsa, Oklahoma. He will devote his time primarily to the recommendation and sales of magnesium anodes. Titterington was graduated from the University of Nebraska in 1934.

▸ **Harris W. Quaite** has been named division office manager of Oil Well Supply Company's Gulf Coast division headquarters office at Houston, Texas. Division headquarters are situated at 947 Mellie Esperson Building. Quaite's appointment is effective immediately. He comes to his new post at Houston from Wichita Falls, Texas, and succeeds **R. R. George,** division office manager since 1949, who is transferring to Calgary, Canada. Quaite joined "Oilwell" in 1933 as an elevator operator at the home office in Dallas.

▸ **I. W. Ferguson** has been promoted to manager, quality control, The Cooper-Bessemer Corporation. The new post of manager, quality control, is an outgrowth in Cooper-Bessemer's continuing effort to improve manufacturing precision, a company release stated. At the same time, **E. C. Phelps** has been elevated to assistant works manager, formerly held by Ferguson. **Harold Johnson** now becomes factory superintendent and **Harry Ceccsarini,** supervisor of the routing and estimating department.

R. R. Matthews

W. W. Carson

▸ **R. R. "Lefty" Matthews** has joined the equipment division of mud Products, Inc. He will be connected with the sale of Mudco O-Ring Butterfly valves, and will direct the sales activity of Mud Products equipment representatives in all districts.

W. W. "Kit" Carson, field representative for Mud Products at Woodward, Oklahoma, has been transferred to the company's headquarters at Tulsa. He will be connected with the sale of Baroid products. Appointed as joint agents for the sale of Mudco O-Ring Butterfly valves in the West Texas and New Mexico area are **R. Q. "Dick" Swindler** and **Harry W. Denton.**

▸ **Howard J. Davis** has been appointed assistant to Colorado Fuel and Iron executive vice president, A. F. Franz. Davis joined CF&I in 1940. In 1947 he was appointed manager of product research and development, later named manager of sales for wire products.

▸ **George L. Duwe,** controller of Cameron Iron Works since 1945, was elected president of the Houston Control of the Controllers Institute of America at the annual meeting held recently at the Shamrock. The meeting marked the 10th anniversary of Houston Control and honored four of the seven charter members of the group. Two of the honorees who were present at the meeting were **Gay Carroll,** comptroller of Humble Oil and Refining Company, and **William A. Baker,** vice president and treasurer of Shell Pipeline.

G. L. Duwe

Other new officers are **Harry B. Drennan,** assistant comptroller of Henke and Pillot, vice president; **Carl B. Myers,** treasurer of Tennessee Gas Transmission Company, vice president; and **Robert C. Wiles,** vice president and treasurer of Pan American Pipeline Company, secretary and treasurer. Directors are: **Richard R. Allen,** controller of Levingston Shipbuilding Company, Orange; **Joe B. Cook,** secretary-treasurer of Woodley Petroleum Company; **John B. Cookenboo,** treasurer and controller of Houston Natural Gas; **Paul Garmany,** controller of Hughes Tool; **Joseph Imber,** secretary-treasurer of Fish Engineering; **Weldon Padgett,** controller of Schlumberger Well Surveying; and **Herbert M. Rowe,** vice president and controller of the Second National Bank.

R. P. Long

A. J. Tysenn

▸ **Robert P. Long,** Maumee, Ohio, has been named as insulation engineer for the Kaylo Division of Owens-Illinois Glass Company. His duties will consist of technical advice and liaison between customers and Toledo.

Anthony J. Tysenn, Merchantville, New Jersey, has been assigned to the Philadelphia office as sales engineer for the Kaylo Division. Tysenn was employed by the Kaylo Division in February, and had been in training until May 15 when he was sent to the Philadelphia office for field training. He replaces **H. L. Pickel,** who left the company on June 8.

O. Cochran

J. B. Link

▸ **Orville Cochran** has been named supervisor of gas products and Nordstrom valves in the Rocky Mountain area. Cochran has been affiliated with Rockwell for over 25 years. During that time he has served as head of the service department, sales engineer, and field representative for Nordstrom valves.

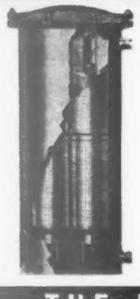
John B. Link has been named valve engineer for the Southern California area for Rockwell. In his new position he will be responsible for the sale of valves used by oil refineries and engineering companies in the area.

▸ **I. Melville Stein** has been elected executive vice-president of the Leeds and Northrup Company, Philadelphia manufacturers of electrical measuring instruments, automatic controls, and heat-treating furnaces. Stein has been a vice president, and is director of research. He joined Leeds and Northrup in 1919 as a division manager in the sales department.

▸ **Sheldon R. Harper** has been placed in charge of sales promotion and advertising for the mechanical goods division of the Goodyear Tire and Rubber Company, replacing **R. W. Sabine,** who has been promoted to manager of distributors sales for the division. Harper joined Goodyear Aircraft Corporation in 1940. He was graduated from Ohio State University.

S. R. Harper

HILCO LUBE AND FUEL OIL PURIFICATION FOR DIESEL AND GAS ENGINES . . .



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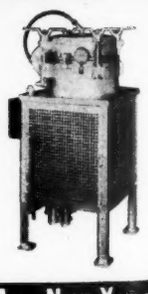
THERE'S A HILCO FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM . . .

YOU WANT CLEAN OIL AND CLEAN ENGINES TO SAVE EQUIPMENT - OIL AND MONEY - INVESTIGATE HILCO OIL MAINTENANCE METHODS

★ ***WRITE FOR FREE LITERATURE - NO OBLIGATION***



• THE HILLIARD CORPORATION, 209 W. FOURTH ST., ELMIRA, N. Y. •

IN CANADA — UPTON-BRADEEN-JAMES, LTD. — 990 BAY STREET, TORONTO, 3464 PARK AVE., MONTREAL

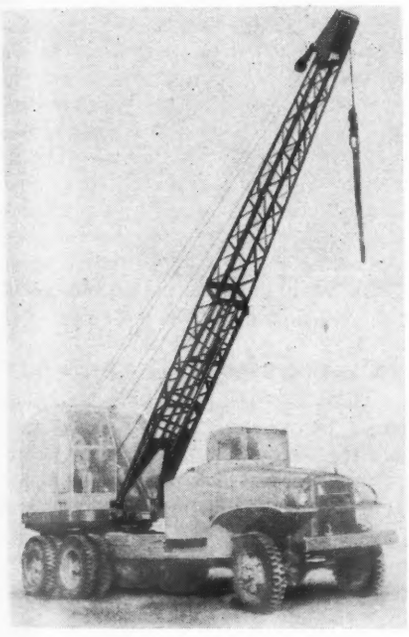
New Machinery and Supplies

Use reply card to procure promptly complete information and prices of products described here in brief.

Circle corresponding letter or letters on reply card.

(A) LIFTING BOOM

A new heavy-duty boom, designed especially for lifting and loading with its 5 ton truck-mounted Bantam shovel-crane, has just been announced by Schield Bantam Company. Available in 25 ft length, with 5 ft extensions, the new Bantam boom is said to have approximately 4 times more rigidity than standard booms, due to use of heavier reinforcing and bracing. The new boom is especially adaptable for logging operations, pipe handling, steel erection, industrial materials handling, thus increasing the work range of the Bantam. Schield Bantam Company.



Circle letter (A) on reply card.

(B) MARINE, BARGE HOSE

Chiksan Company has announced that its aluminum marine and barge hose offers many advantages not found in rubber or synthetic hose. One of the primary advantages is the lighter weight of the aluminum, as well as the fact that the hose is not affected by temperature. In addition to marine operations, the aluminum hose is employed as a transfer line for manifold installations. Chiksan Company.

Circle letter (B) on reply card.

(C) RECORDING BAROGRAPH

A new recording Micro barograph has been developed by the American Paulin System. All power in the actuating and recording mechanism is supplied by two heavy sealed instrument clocks and no power is taken from the pressure-sensitive device. The barograph records a pressure curve over a range of plus or minus 1.00 in. mercury and can be used at any elevation from sea level to 10,000 ft by means of a reset. American Paulin System.

Circle letter (C) on reply card.

(D) DAMPING DEVICE

To overcome excessive galvanometer fluctuations due to non-uniformity of samples, a new damping mechanism has been developed for the TAG-Heppenstall moisture meter for grain by the Tagliabue Instruments Division, Weston Electrical Instrument Corporation. The TAG-Heppenstall requires no weighing of samples. Operated simply by pressing a button, the new damping device reduces pointer oscillations for quick and accurate readings even under conditions of extreme variation. Weston Electrical Instrument Corp.

Circle letter (D) on reply card.

(E) MECHANICAL FOAM

National Foam System, Inc., has introduced a product, Aer-O-Foam "99," a liquid type mechanical foam for use on fires involving polar solvents or petroleum products.

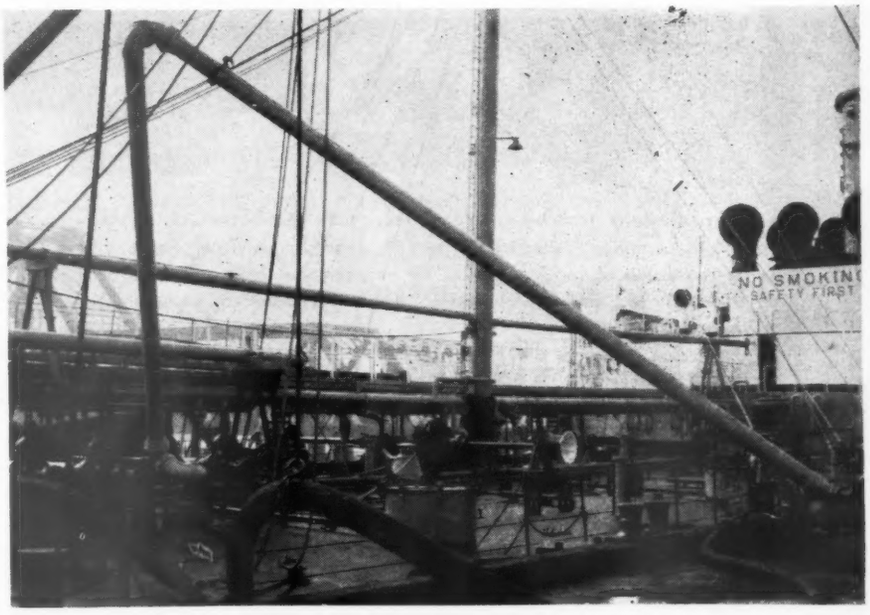
Aer-O-Foam "99" is non-corrosive, and is a mobile, free-flowing liquid even at temperatures as low as 10 F. If frozen, it maintains its effectiveness on thawing out. Another advantage of this new mechanical foam is that it may be used with existing 6 per cent mechanical foam making proportioning devices. These provide an average expansion of 10. National Foam System, Inc.

Circle letter (E) on reply card.

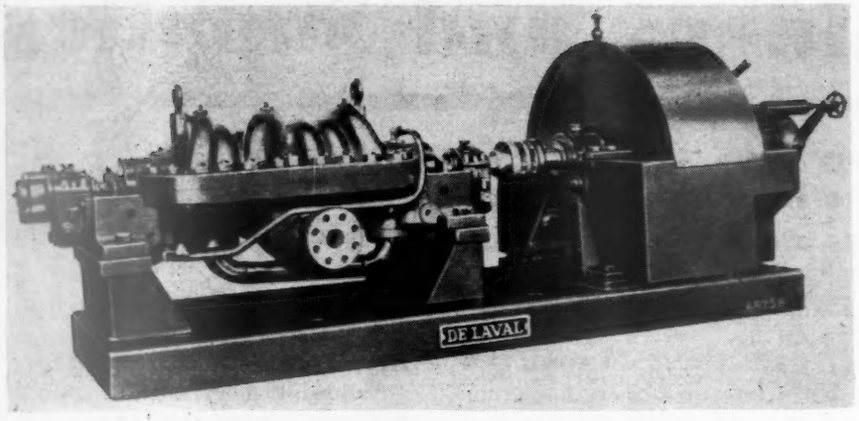
(F) PLASTIC COATING

Tube-Kote, Inc., announces a new product, TK-43, a rubbery-type copolymer baked-on plastic coating. Where the flow of abrasive solids is destroying the pipe, TK-43 is especially adapted, the manufacturer claims. It is applied to the metal surface in multiple coats to produce a film thickness up to 30 mils, which provides a high degree of resistance to abrasive solids flowing through the pipe. Tube-Kote, Inc.

Circle letter (F) on reply card.



Chiksan Company's aluminum marine hose in use.



One of De Laval's new impeller pumps.

(G) IMPELLER PUMPS

De Laval has announced a new line of 4, 6 and 8 stage opposed impeller pumps, designed for general medium pressure and temperature service up to approximately 1000 gpm and 1200 psi for temperatures to 350-400 F. They are especially well suited to boiler feed service, oil refinery services for handling liquids ranging from propane to strong caustic, and general water services such as descaling, hydraulic, and mine drainage. De Laval Steam Turbine Company.

Circle letter (G) on reply card.

(H) ORIFICE

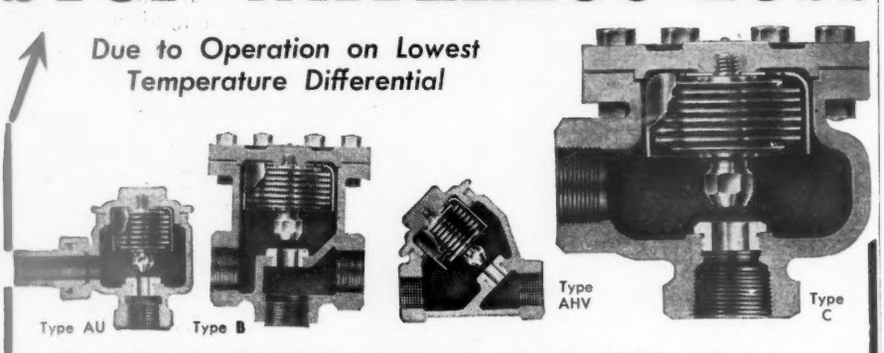
George Kent Ltd. has announced production of a "PL" type orifice, to use in measuring the rate of flow of fluids. The orifice, which is available in two forms, gives a coefficient of discharge that is unaffected by wide variations in the viscosity of the fluid passing through it. The "PL" orifice plate is made of stainless steel, and designed to give the required differential pressure at specified maximum flow using two pipes to transmit pressure to the recorder. George Kent Ltd.

Circle letter (H) on reply card.

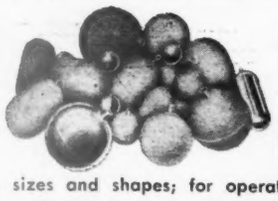
Nicholson Steam Traps

STOP WATERLOG LOSS

Due to Operation on Lowest Temperature Differential



Repeated comparative tests by large trap users show that Nicholson traps operate on lowest temperature differential: 5° to 15°, depending on trap size and steam pressure. Production of cooking kettles, for example, has been increased as much as 30% because fast action of Nicholson traps keeps equipment full of live steam. They are specified for all apparatus where back-up of condensate causes corrosion or damage to thin gauges. 5 types for every application; size ¼" to 2"; pressure to 225 lbs.



HIGH-PRESSURE FLOATS — Stainless monel, steel, or plated steel. Welded. In all sizes and shapes; for operating mechanisms and as tanks or vesse'ls. Quick delivery. BULLETIN 650.

BULLETIN 450 or Refinery Catalog

W. H. NICHOLSON & CO., 217 Oregon St., Wilkes-Barre, Pa.

(I) GEARED MOTORS

A new principle in geared motors has been developed by U. S. Motors in their Type GL Syncrogear. By using *two* secondary pinions to drive the output gear, U. S. engineers have doubled the effective torque rating of a conventional single pinion and gear unit, a company spokesman claims. Incorporating the use of a splined herringbone pinion to equally divide the load between the two secondary pinions, the Type GL Syncrogear produces high torque at low speeds, while occupying only a fraction of space required of a conventional drive. U. S. Electrical Motors, Inc.

Circle letter (I) on reply card.

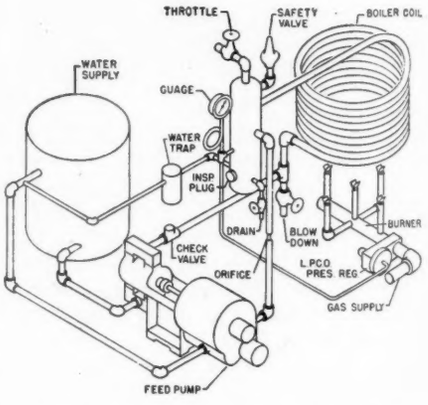
(J) RADIOPHONE

A new version of the Motorola "Handie-Talkie" portable F.M. radiophone that incorporates an adjustable squelch is being introduced by Motorola. The squelch reduces the annoyance of tube and circuit noises normally encountered in an F.M. receiver in the absence of a signal. Mounted on the power supply chassis, the squelch control provides a normal operating range of no-squelch up to 25 to 50 db noise reduction. Motorola.

Circle letter (J) on reply card.

(K) CONTROL BOILER

The Vanderlei Manufacturing Company, has recently placed on the market the automatic orifice control waterman boiler. This is a complete unit for treating oil to remove water and



change viscosity. It is made in 30-hp sizes and has a 200-lb working pressure wet or dry steam. The manufacturer claims that the unit is extremely simple, as it has only three working parts. The firebox is eliminated, no pit is required for either open or closed steam systems. No gears, pulleys, bearings, belts, or electric controls are required. It is a complete unit, ready to be connected to fuel and water lines. Electricity is required only for the oil-fired unit, which has an electrically operated blower. Vanderlei.

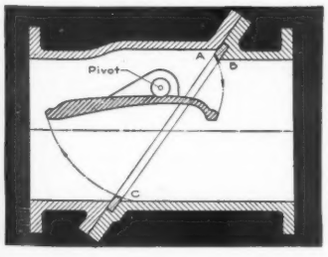
Circle letter (K) on reply card.

YOU GET *Cushioned Closing* WITH CHAPMAN TILTING DISC CHECK VALVES

There's no impact on closing — with this valve by Chapman. The balanced disc rides the flow smoothly — uses the fluid or gas itself to cushion the closing action. The disc lifts away from the seat easily on opening; closes quickly, positively—yet quietly.

Consequently, there's no rubbing on the seats—little wear on hinge pins and bearings. Repair needs are at a minimum — maintenance costs low.

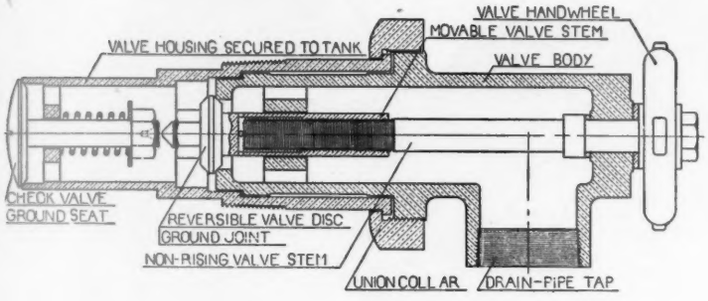
Chapman Tilting Disc Check Valves are available in either iron or steel. Write today for catalog with complete technical information.

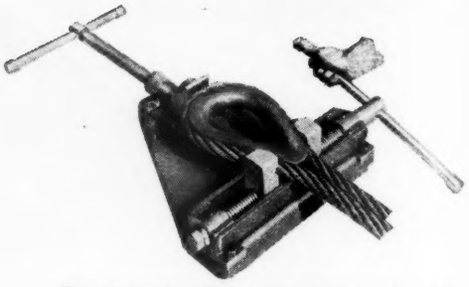


Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

Airtool water draw-off valve, which the company claims has cut down freezing of valves in refineries.





Forming vise for wire rope and cable now being made by Big Four Machine and Supply Company.

(L) WATER VALVE

A unique water-draw-off valve developed by The Airetool Manufacturing Company, has resulted in a substantial reduction in the number of frozen valves in the refinery industry during the past winter, the company reports. Because storage tanks tend to accumulate water, Airetool engineers designed this specialized valve to draw water off tank bottoms, thereby reducing failures due to valves freezing.

The valve is available in both 2-in. and 3-in. sizes to fit 2-in. and 3-in. openings. The Airetool Manufacturing Company.

Circle letter (L) on reply card.

(M) FORMING VISE

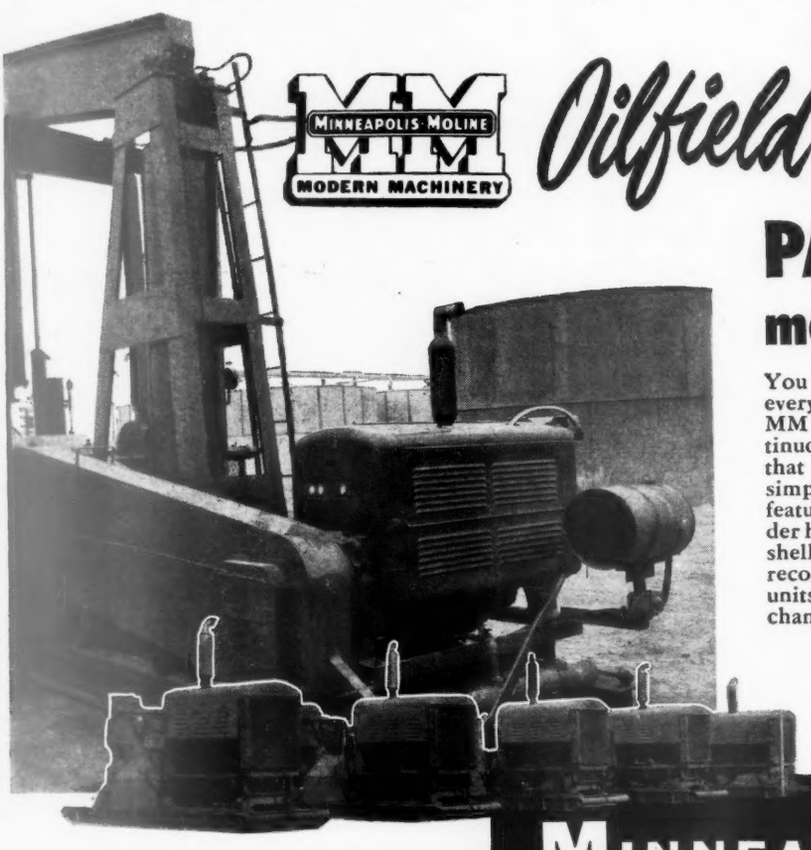
The McDermott Riggers' forming vise for wire rope and cable is now being manufactured by Big Four Machine and Supply Company. The McDermott forming vise forms and holds wire rope and cable easier in the desired position and saves considerable time in forming wire rope and cable around thimbles or fixtures for making slings for either splicing or "U" clamp and clip installations. This vise handles wire rope and cable from 3/8 to 1½-in. without use of adapters. Big Four Machine and Supply Company.

Circle letter (M) on reply card.

(N) ROCK SHIELD

A new product, Fiberglas pipe line rock shield, for use during pipe wrapping operations in rough terrain, has been announced by Owens-Corning Fiberglas Corporation. Rock shield is a prefabricated cushioning material of high impact strength, made of bitumen blended with inorganic filler and reinforced with Fiberglas Coromat inner wrap. It is applied by a two-man crew with pressure-sensitive tape or metal strap, and made in roll or sheet form, won't sag, shrink, or disintegrate. Owens-Corning Fiberglas Corporation.

Circle letter (N) on reply card.



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MM engines have an enviable record of continuous duty without mechanical shutdown and are available in 7 sizes from 25 to 180 hp. Only MM Oilfield Engines have built-in Heat Exchanger Base Pans to give you lowest field maintenance!

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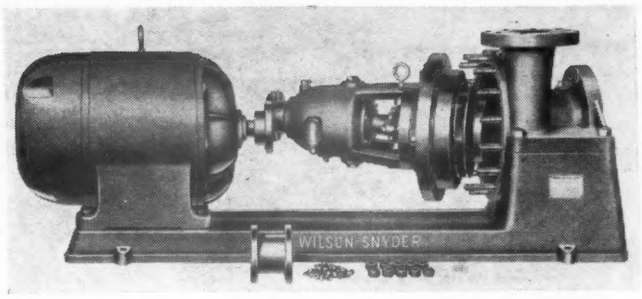
MINNEAPOLIS 1, MINNESOTA



Oil Well Supply single stage centrifugal pumps, for use where continuity of operation is important.

(O) CENTRIFUGAL PUMPS

Two new models of centrifugal pumps have been added to the Wilson - Snyder Manufacturing Division of Oil Well Supply Company. Type ES single-stage centrifugals are designed for the various process applications where continuity of operation is important, temperatures or pressure may be high, hot or cold liquids are handled near their boiling points, and broad capacity range at high efficiency is desirable. Wilson-Snyder Division, Oil Well Supply.

Circle letter (O) on reply card.

(P) MINIATURE UNITS

Bailey Meter Company has developed new miniature indicators and control units, offered under the trade name Mini-Line. These instruments, which reduce space requirement for control panels, can concentrate into a small space before a single operator all information and controls for operating one or more boilers, turbines, etc. A new indicator uses 87 per cent less space, a selector valve, 52 per cent less, and a remote manual relay 70 per cent less. Bailey Meter Company.

Circle letter (P) on reply card.

(Q) FLOW PUMPS

The Aldrich Pump Company announces the addition of a 6-in. stroke direct flow pump series to its over-all line. This series includes triplex, quintuplex, septuplex and nonuplex units, having 3, 5, 7 and 9 plungers, respectively. Ranging from 300 to 900 hp, the 6-in. stroke series covers numerous applications, such as chemical handling, steel mill descaling, water injection in oil fields, lean oil pumping, etc. Aldrich Pump Company.

Circle letter (Q) on reply card.

(R) FIRE EXTINGUISHER

A 4-lb dry chemical fire extinguisher with a rubber hose is now on the market. Introduced by Ansul Chemical Company, discharge time on the Ansul 4-B has been increased, giving untrained personnel more time to extinguish the fire. Operating range of the extinguisher is 12 to 15 ft. It has received a B2, C2 rating from Underwriters' Laboratories. Dry chemical is ejected from the Ansul 4-B through a self-closing nozzle. Ansul Chemical Company.

Circle letter (R) on reply card.

(S) WELLHEAD STUFFING BOX

The Pelton stuffing box has been developed specially to compensate for polished rod misalignment, a statement released by the company reported. For use on any rod pumped well, the Pelton self-aligning stuffing box will accommodate as much as 1-in. misalignment. The upper portion of the box containing the packing floats horizontally on the smooth face of the lower body. A rubber "O" ring provides the seal between the two sliding surfaces. Pelton ring-type packing in the upper casting seals the polished rod against leakage. Pelton Water Wheel Company.

Circle letter (S) on reply card.

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ALL MERCURY SWITCH EQUIPPED AUTOMATIC CONTROLS

THEY ARE USED FOR THE CONTROL OF TEMPERATURE, PRESSURE, LIQUID LEVEL AND MECHANICAL OPERATIONS.
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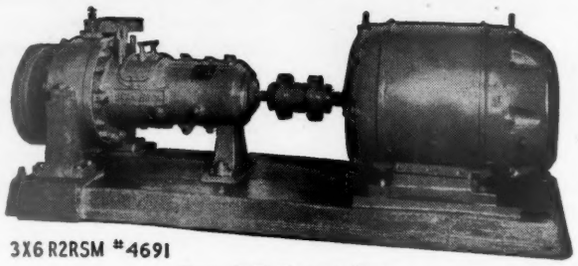
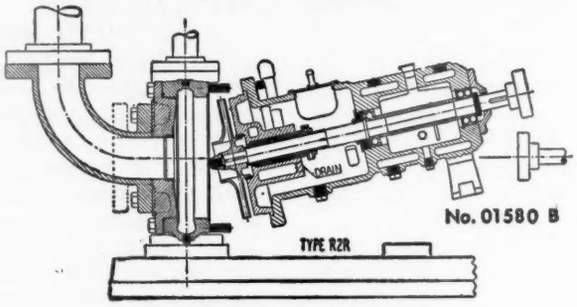
DEAN BROTHERS PUMPS INC.

Type R2R Centrifugal Process Pumps



Type R2R Process Pump



Type R2R Process Pump

DISASSEMBLY: The Type R2R process pumps can be disassembled without disconnecting the suction and discharge piping. By first removing the spacer from the spacer type coupling, and unbolting the casing from the cradle the entire cradle and complete rotating element can be removed without disturbing the suction and discharge piping.

OPERATING RANGE: Type R2R, Heavy duty, process pumps are available in eighteen different sizes, enabling our engineers to furnish units specially designed and constructed for the particular work to be performed.

Capacities: 50 to 2000 Gallons per minute. Heads: Up to 400'. Speeds: 900 RPM to 4000 RPM.

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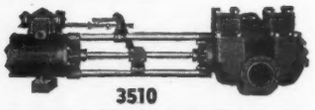
CENTRIFUGAL and RECIPROCATING PUMPS

Close Coupled Centrifugal Pump



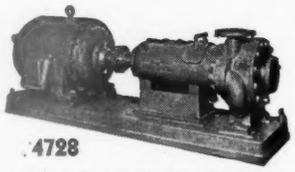
3510

Horizontal, Single Style, Double Acting, Piston Type, Close Clearance Pump. Designed to handle volatile liquids

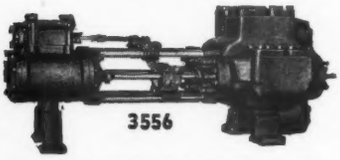
Pedestal Mounted Centrifugal Pump

3833

Horizontal, Duplex, Double Acting, Side Pot, Piston Type, Oil Bath Power Pump



Double Pedestal Bearing Centrifugal Pump



3556

Durable Duplex Packed Piston Pattern Steam Pump, Side Pot Type

ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.

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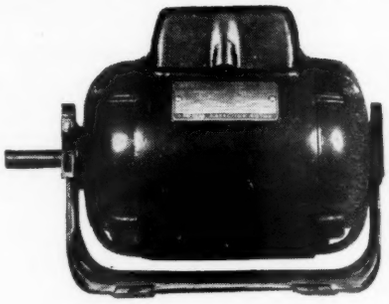
Representatives in Principal Cities

(T) INDUCTION MOTOR

General Electric's Tri-Clad line of single-phase, capacitor, induction motors is now being offered with a resilient-base construction, it was announced recently by the company. For use where freedom from vibration and extra-quiet operation are required, the construction is available on motors rated from ½ to 5 hp. Ac-

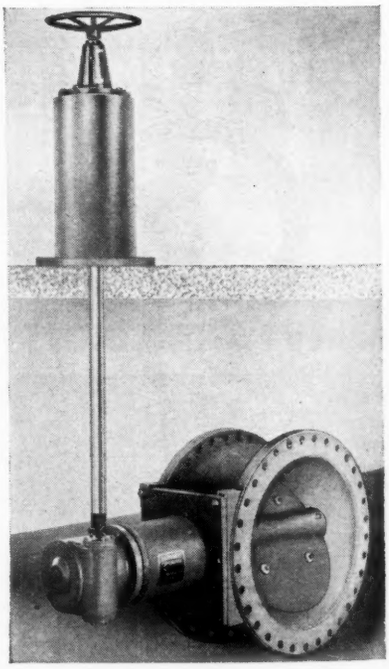


cording to G-E engineers, all single-phase motors have some torque pulsation, but the resilient base isolates this vibration so that it is not transmitted to the driven machine. General Electric.

Circle letter (T) on reply card.

(U) CONTROL VALVE

R-S Products Corporation has available a new heavy-duty control valve, No. 788, with totally enclosed

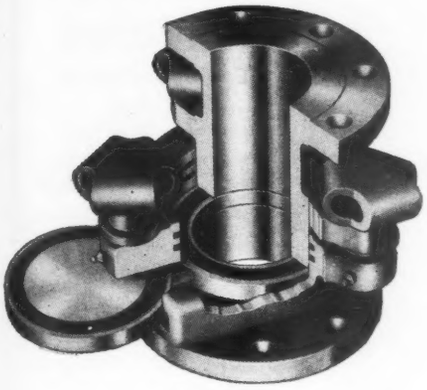


gear reduction drive, and extended shaft and floor stand. The sealing of water pressure is obtained by utilizing a babbitted seat in the body and Monel or stainless steel welded to the periphery of the valve disc. Such metal-to-metal seat gives satisfactory commercial shut-off in most installations. R-S Products Corporation.

Circle letter (U) on reply card.

(V) LINE VALVE

A new Hamer oil tool "Fluid Saver" type line blind valve combining spill-proof and self-aligning features with 3-bolt operation is now available. By turning the operating bolts with a



short, straight bar one man can release the spectacle plate, reverse it, and seal it securely again in less than one minute. The two-piece body has telescoping hubs that slide one within the other, and have internal packing between them. This design provides a fully enclosed chamber for the spectacle plate and also makes the line blind valve resistant to sidewise strains due to misalignment of the piping. Hamer Oil Tool Company.

Circle letter (V) on reply card.

(W) FIRE FIGHTING

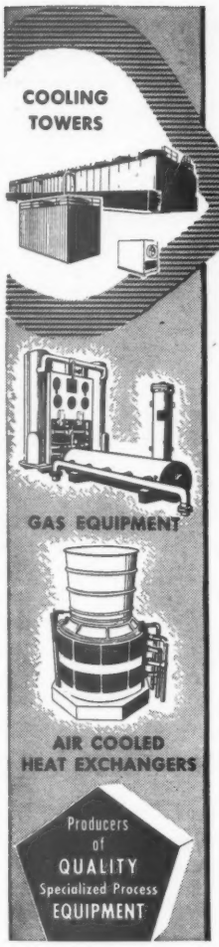
A new piece of fire fighting equipment developed recently is the injecta-line, an accurate proportioner designed for use with wetting agents. Its purpose is to simplify the use of agents by direct introduction into hose lines of controlled percentage concentrations for any type of fire. Important feature of the proportioner includes the ability to be recharged under full pump pressure. Instantaneously operated manual controls are said to permit variation in concentration at any point between ½ gal to 3 gal of wetting agent to each 1,000 gal of water. Solvoid Division of American Marine Paint Company.

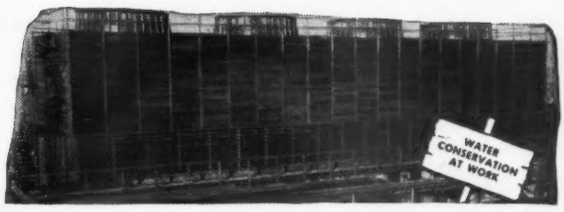
Circle letter (W) on reply card.

(X) SCREW STARTERS

Bonney Forge and Tool Company reports development of its new slot-head screw starters. The new tool provides a gripping head that holds screws firmly for starting. Screw is released by turning handle. It is available with metal handles in 4 lengths —2½, 5, 9, and 15 in., or in 6 and 9 in. with nylon handles. Bonny Forge and Tool Works.

Circle letter (X) on reply card.





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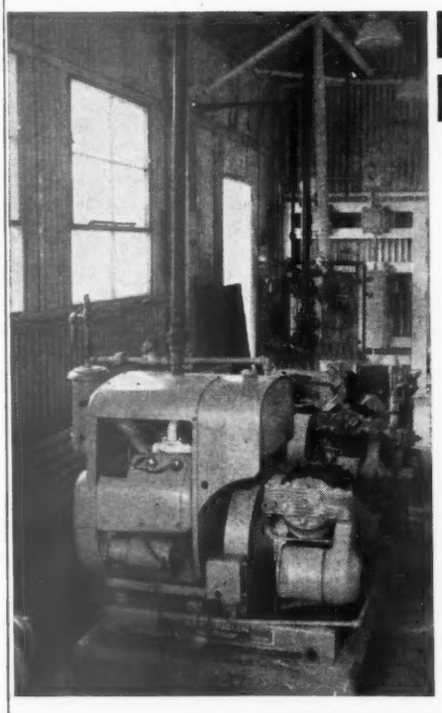

Delivering air under pressure is the vital task of this unit that *works great under pressure* at a big Texas field. It's a Worthington Compressor powered by a Wisconsin Heavy-Duty Air-Cooled Engine.

Actually, a power station is no better than its mechanized units, and these, no better than the power components powering them . . . which is why *you'll do better* specifying or buying Wisconsin in the 3 to 30 hp. range. Tapered roller bearings at both ends of the crankshaft taking up all thrusts and an easily-serviced OUTSIDE magneto with impulse coupling for quick, easy starting and any-weather running, are partly responsible for Wisconsin Engine success. But, equally important is *air-cooling*, eliminating cooling problems. Fueling and minor maintenance are the only servicing reasons for shutting down a Wisconsin Engine.

4-cycle single-cylinder, 2-cylinder and V-type, 4-cylinder models, 3 to 30 hp.

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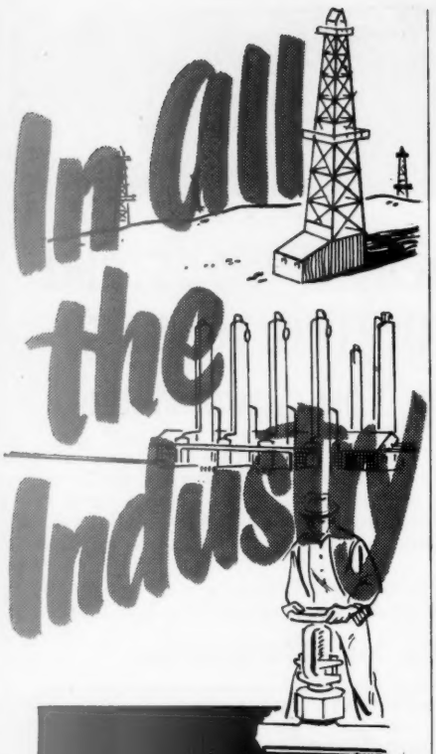

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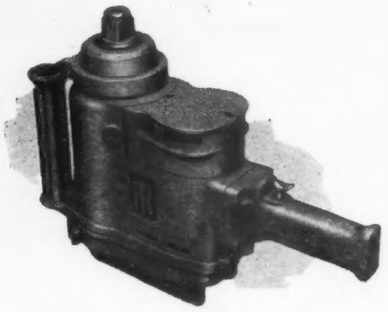
(Y) ELECTRIC IMPACTOOL

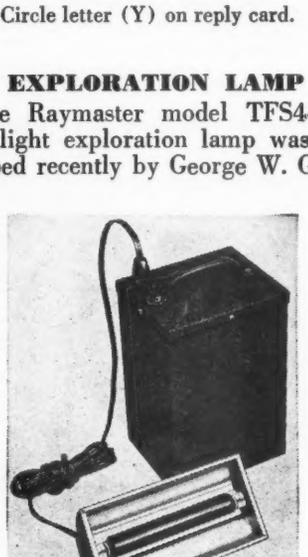
A new, heavy duty universal electric Impactool for tough nut running jobs in truck, bus, and industrial maintenance fields has just been announced by Ingersoll-Rand Company. Known as the Size 34U Impactool, it has a 1-in. square driver, and is rated for bolts up to 1¼-in. size. The new tool employs a universal electric motor and an I-R impact unit, placed side by side to reduce overall height, which permits handling truck U-bolt nuts without jacking up the truck. The impact mechanism automatically converts the power of the electric motor to hundreds of rotary impacts whenever sufficient resistance to turning is met. Ingersoll-Rand Company.



Circle letter (Y) on reply card.

(Z) EXPLORATION LAMP

The Raymaster model TFS4-B90 blacklight exploration lamp was developed recently by George W. Gates and Company, Inc. The lamp was developed for use in detecting leaks of liquids in vessels of all sizes, its effectiveness depending on the phenomenon of fluorescence. A dilute solution of an effective fluorescing agent is placed inside the container to be tested. The slightest flow through the wall is signalled by a bright glow under the influence of the rays from the exploring lamp. The lamp is battery operated freeing it from hazards of shock from power circuits. George W. Gates and Company.



Circle letter (Z) on reply card.

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LOW COST LIGHTING

for Gages, Rotameters, etc.

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Single and Double Section Jerguson Illuminators on a 3-Section Gage.

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YOU get even, no glare, Low Cost Lighting with Jerguson Gage Illuminators . . . the improved illuminators that are unexcelled for gages, rotameters, etc. They give you ideal illumination with safety . . . and make possible faster, easier, accurate reading.

Jerguson Illuminators use the principle of solid wedge lighting to give you *clear, even lighting, without bright spots.* Light flows through the plastic wedge and is reflected evenly. A single small bulb gives you better illumination at a cost so low that savings quickly pay for the illuminator.

Jerguson Illuminators are approved by Underwriters' Laboratories and are built in accordance with their Standard for Electric Lighting Fixtures for use in hazardous locations for Class 1, Group D Services. Made in a variety of sizes; also available in a non-explosion proof model.

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Trade Literature

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(AB) GAS TURBINE

A new 2-color booklet on the G-E gas turbine for pipe line pumping has been announced. The bulletin describes the features of the equipment, its application and operation. It is illustrated with photographs, line drawings and charts showing horsepower limits for various ambient temperatures. A breakdown chart, showing the components of the turbine is also included in the publication. General Electric.

Circle letters (AB) on reply card.

(AC) PROCESS PUMPS

Two booklets have been published by Sigmund Pumps, Ltd., of special interest to refinery engineers and those associated with the refining industry. The first of these, "The Home of Sigmund Pumps," is a short resumé of the organization, facilities and services offered. The second, "A Few Installations of Sigmund Process Pumps," gives a fair cross-section of Sigmund pump installations, some of which handle liquids ranging up to 950 F. Sigmund Pumps Ltd.

Circle letters (AC) on reply card.

(AD) PUMP MOTORS

E-M Synchronizer No. 33, latest in the series of quarterly publications by the Electric Machinery Manufacturing Company, deals with large pumps and the application of a-c motors to them. In an illustrated lead article by George R. Thompson, city engineer for the city of Detroit, Michigan, the new Detroit storm water pumping project is discussed. Other articles cover applications of large a-c motors to centrifugal pumps, cooling water pumping in the petroleum industry, etc. Electric Machinery Manufacturing Company.

Circle letters (AD) on reply card.

(AE) CHAIN DRIVES

A new bulletin has just been published by Chain Belt Company of Milwaukee, of great interest to all who design, install, maintain or operate chain drives and conveyors. The text is short, and most of the illustrations show graphically the correct and incorrect ways of solving chain installation, operation and maintenance problems. Chain Belt Company.

Circle letters (AE) on reply card.

(AF) STEEL TUBING

Assistance in solving problems involving the use of alternate grades of low carbon, or carburizing grades of tubing steels, is offered in a new 4-page bulletin published by Babcock and Wilcox Tube Company. The Bulletin presents condensed data on microstructure, critical points, effect of alloy elements, forging, machining, welding, and thermal treatment for 14 well-known alloy steels used in the production of tubular parts. Babcock & Wilcox Tube.

Circle letters (AF) on reply card.

(AG) DIESEL ENGINES

A recent Caterpillar publication that features "Cat" diesel engines for every power need, is now available. There are 12 sizes of Caterpillar diesels which enable power users to choose the right size units to meet specific requirements. The booklet contains complete specification on each engine and available attachments. Many illustrations present "Cat" power on a variety of jobs. They show the reader how widely and dependably Caterpillar machinery works. Caterpillar Tractor Company.

Circle letters (AG) on reply card.

(AH) STEAM TRAPS

A new 3-page catalog discussing Nicholson steam traps recently was published. Price lists, capacity charts, and diagrams give complete details on the Nicholson steam traps. This comprehensive booklet also lists some of the features of the Nicholson traps as being: High ratio of effective bellows area to orifice area, and distilled water bellows fill under vacuum, affording low temperature differential operation and large capacity; hardened stainless steel seats and valves, and many others. W. H. Nicholson and Company.

Circle letters (AH) on reply card.

(AI) HUMIDITY MEASUREMENT

Minneapolis - Honeywell Regulator Company has issued a new instrumentation data sheet, describing the new concept of humidity measurement that makes possible direct humidity readings from remote locations. The company reports development of a humidity sensing element to operate with the ElectroniK potentiometer, thereby providing per cent relative humidity records that are direct. Minneapolis-Honeywell Regulator Company.

Circle letters (AI) on reply card.

(AJ) MEASURING METERS

A new bulletin covering proper selection of meters for measuring more than 200 chemicals, petroleum products and other liquids with varying corrosive characteristics has just been issued. Rockwell industrial meters, covered by the bulletin, are built with cases and parts of a variety of metals and other materials, and are assembled to specification depending upon service conditions. Rockwell Manufacturing Company.

Circle letters (AJ) on reply card.

(AK) SYNTHETIC RUBBER

A complete presentation on the characteristics, properties, uses, and methods of application of synthetic rubber resin based coatings is contained in a new 2-color, 8-page brochure just issued by the Casey & Case Coating Company. Covered are machinery enamels, damp-wall enamels, stucco-masonry coatings, and scuff-free floor finishes. Casey and Case Coating Company.

Circle letters (AK) on reply card.

(AL) TUBING LEAKS

Hydro-Test, Inc., developers of pressure-testing for pipe and tubing, has issued an illustrated bulletin describing the method in detail. Hydro-Test finds leaks in tubing while the tubing is being pulled, while it is being run back into the well, or at the rack. Portable powered equipment is brought to the rig or pipe yard where it locates all leaks, large or small. Hydro-Test, Inc.

Circle letters (AL) on reply card.

(AM) FLOW PUMPS

Aldrich Pump Company has just released Data Sheet 67-A, describing the Aldrich 6-in. stroke direct flow pump series. A 2-color, 8-page bulletin, Data Sheet 67-A gives full details of design and construction including dimension and sectional drawings, performance data and pump specifications. Aldrich Pump Company.

Circle letters (AM) on reply card.

(AN) CONVEYOR BELTS

A 40-page catalog concerned with spiral woven wire conveyor belts and conveyor systems has been announced by Korb-Pettit Wire Fabrics and Iron Works, Inc. The bulletin contains illustrated standard and special wire belting weaves with specifications and detailed descriptions. Power formulae and construction details are covered fully as well as suggestions for prolonging belt life and increasing efficiency. Korb-Pettit Wire Fabrics and Iron Works, Inc.

Circle letters (AN) on reply card.

(AO) BUS DUCT

A new 68-page manual describing types of bus duct and accessories available, and presenting application and test data, specifications, information on pricing a typical bus duct installation, and a typical bill of materials, is available from Westinghouse Electric. Initial sections in the booklet describe advantages of bus duct for a secondary power distribution system, carrying current from transformers to switchgear—and from there to other electrical equipment. Westinghouse Electrical Corporation.

Circle letters (AO) on reply card.

(AP) GAS CONDITIONING

Blaw-Knox Company has published a research bulletin (Number 2353) on gas conditioning and Blaw-Knox gas equipment. The 20-page pamphlet contains some illustrations, including photomicrographs, showing the effects of entrained wet and dry dusts. There is a review of a new method for determining the entrained dust and oil content of gas streams, a "yardstick" developed by the Blaw-Knox research department, along with photos of the testing apparatus. Blaw-Knox Company.

Circle letters (AP) on reply card.

(AQ) PIPE COATING

A bulletin is being offered by The Trenton Corporation that describes the many uses of Mummy-Wrap pipe coating and wrapper, and contains a table giving material requirements for various size pipe. The line of protective coatings includes "dopes" for hot and cold application by hand and machine. Wrappers are made of plastic, plus certain other materials, which have been developed especially for use on underground pipe. The Trenton Corporation.

Circle letters (AQ) on reply card.

(AR) PICKLING, PAINTING

Chicago Bridge and Iron Company has published a new 8-page booklet which contains information on the pickling and painting of steel plates, angles, channels and other shapes produced by rolling. The Phoscote process removes mill scale from steel plates and shapes by immersing the material in baths of sulfuric acid, wash water and phosphoric acid. It provides a clean, dry surface with a coating of iron phosphate. Chicago Bridge and Iron Company.

Circle letters (AR) on reply card.

(AS) SINGLE-SEATED VALVES

A valve catalog has been made available to the public by The Annin Company. The 20-page catalog describes in detail the operation and performance of all Annin single-seated valves. The manufacturer states that its valves are applicable to most of the complex control problems commonly encountered in the processing industries—petroleum, chemical, etc. The Annin Company.

Circle letters (AS) on reply card.

(AT) DELAYED COKING

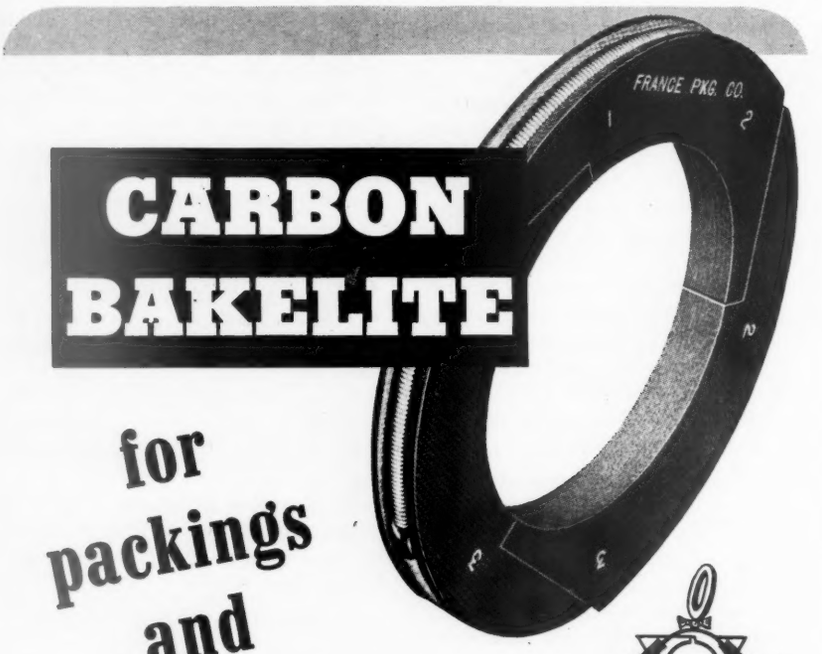
A 20-page brochure has just been published by The Lummus Company, covering delayed coking process generally, and Pan-Am Southern Corporation's Lummus-built El Dorado, Arkansas, unit specifically. The booklet discusses the economics and processing significance of delayed coking. A flow diagram of the Pan-Am Southern unit, including operating data, is reproduced. The Lummus Company.

Circle letters (AT) on reply card.

(AU) DRYERS

Standard convection-cooled dryers is the subject of a 4-page bulletin recently published by C. M. Kemp Manufacturing Company. These dryers are available as standard models to provide continuous drying capacity. Dryer consists of dual absorption towers and a completely closed reactivation system. C. M. Kemp Mfg.

Circle letters (AU) on reply card.



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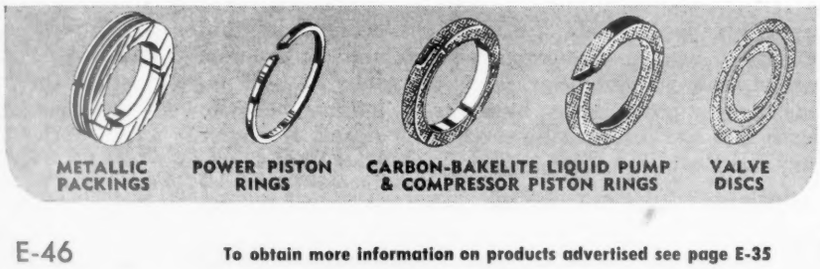

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(AV) PUMP DRIVES

An 8-page 2-color bulletin has been published by Johnson Gear and Manufacturing Company, Ltd., on its turbine pump drives. The catalog contains cutaway diagrams of the right angle gear drive, standard dimension of Johnson drives, and various tables to assist in the selection of a correct gear drive. Other diagrams and charts give valuable data on the selection of gear drive. Johnson Gear and Manufacturing Company, Ltd.

Circle letters (AV) on reply card.

(AW) SWIVEL JOINTS

New catalogs and bulletins issued recently by Chiksan Company, include 20-page catalog No. 50-D covering Chiksan ball-bearing swivel joints and fabricated products for the petroleum industry as well as for chemical and industrial applications; 4-page bulletin covering dimensions of Chiksan swivel joints; 4-page bulletin on packing sets for all Chiksan swivel joints. Chiksan Company.

Circle letters (AW) on reply card.

(AX) PRECISION TOOLS

The importance of heat processing machines as automatically controlled precision tools in production lines is highlighted in a new bulletin, "Precision Tools for Production," issued by Selas Corporation of America. Descriptions and illustrations include metal brazing, selective hardening, heating-for-forging, tinplate fusion, melting, normalizing, etc. Selas Corporation of America.

Circle letters (AX) on reply card.

(AY) PIPELAYING

A new 12-page booklet has been published by the International Harvester Company. The part International crawlers play in handling every phase of the pipelaying business is presented in picture-caption style. In addition, the 2-color booklet contains a Selectograph showing the lifting capacity of each International tractor when working with a matching pipeboom. International Harvester Company.

Circle letters (AY) on reply card.

(AZ) AIR-COOLED ENGINES

Wisconsin Motor Corporation has published a 2-color, 6-page booklet describing its air-cooled engines and their application. The manufacturer lists as some of the air-cooled engine advantages — there are no cooling problems at any season. Wisconsin engines may be mounted on practically any type machine, and many others. Wisconsin Motor Corporation.

Circle letters (AZ) on reply card.

(BA) DRILLING HEADS

The Guiberson Corporation has published an 8-page booklet describing in detail its Type "K" drilling heads. The company recommends its rotating drilling head for well completion work when drilling in under controlled pressure with either conventional or reverse circulation. A choice of union or flange type bottom connections is offered. Rubbers and top rubber supports range in sizes to accommodate up through 3-in. upset tubing, the company reports. The Guiberson Corporation Company.

Circle letters (BA) on reply card.

(BB) MAGNETIC DRIVE

Publication 1107 has been released by Electric Machinery Manufacturing. This 32-page book is technical in scope, and contains complete information both on the magnetic drive and the new magnetic amplifier regutron speed control. Many charts, diagrams, and illustrations are included. A fully illustrated section is also included, which covers the applications of the magnetic drive and Regutron Control in industry. Title of the booklet is "Precision Speed Control With the Adjustable Speed Magnetic Drive." Electric Machinery Manufacturing.

Circle letters (BB) on reply card.

(BC) WIRE ROPE

American Steel and Wire has published a most comprehensive book entitled "The Right Rope for the Job." The booklet contains 40 profusely illustrated pages, with color brightening each page. An index in the front lists various industries with specific business listed under them. The exact size and type of rope are recommended for various jobs. Some of the industries include: Oil, gas, and water wells, with cable tool drilling lines, rotary drilling lines, casing lines, etc. American Steel and Wire Company.

Circle letters (BC) on reply card.

(BD) TRUCKS, TRACTORS

The vital transportation role of heavy-duty trucks and tractors in the petroleum industry is described in a new, illustrated pamphlet being distributed by The Autocar Company. The folder is done in 4 colors. The pamphlet points out that heavy-duty trucks and tractors are important in distribution of fuel in the prevailing fan-shaped pattern from storage tanks to retail outlets and to household cellar tanks. Also emphasized is the use of heavy-duty chassis at the production end of the industry. The Autocar Company.

Circle letters (BD) on reply card.

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BOOKS

Structural Geology of North America, *by A. J. Eardley. Published by Harper and Brothers, 49 East 33rd Street, New York 16, N. Y. Price, $12.50. Pages, 620.*

To those geologists concerned with economic aspects, petroleum, and metals, this volume will be of particular interest. It describes in detail the structural evolution of the entire continent. The text describes the crustal unrest of the North American continent in post-Proterozoic time. It covers the formation and constitution of mountain systems, basins, arches, and volcanic archipelangos; the leveling of the highlands, and the filling of basins. There are 16 paleotectonic maps in full color, some 750 separate illustrations, many of them especially prepared for this volume, and a bibliography of 700 selected references.

Reviews of Petroleum Technology in 1948 (Volume 10) *published by The Institute of Petroleum, 26 Portland Place, London, W. I. Price, 27s 6d. Pages, 350.*

Volume 10 of the Annual Reviews covers the progress made in the scientific and technical aspects of the petroleum industry in 1948 and should prove of value to anyone desiring a ready means of tracing the progress of the industry. There are references to over 2000 scientific and technical articles and patent specifications published during the year.

The Woodbine and Adjacent Strata of the Waco Area in Central Texas, *A symposium sponsored by the East Texas Geological Society. Published by Southern Methodist University Press, Dallas, Texas. Price, $6.25, paper; $7.50, cloth. Pages, 157.*

The efforts of the East Texas Geological Society to provide a symposium on the Woodbine sands, this information should add greatly to the proper interpretation of the sedimentary and tectonic history of the East Texas Embayment and contiguous areas. Comparative status of the Woodbine in oil production, history, and discovery of Woodbine fields in East Texas, geology of Belton and Whitney Reservoirs area, Northern McLennan County, and stratigraphy of the Woodbine and Eagle Ford, Waco area, are materials covered in the symposium.

Ira Rinehart's New Mexico Oil—1951-Permian Basin, *compiled by Charles E. Terry. Published by Rinehart Oil News Company, Box 1208, Dallas, Texas. Price, $15, subscribers; $25, non subscribers. Pages, 169.*

The purpose of this volume is to bring together into one reference as many of the facets of the oil industry in Southeastern New Mexico as is possible. A companion volume to "Ira Rinehart's West Texas Oil-1949," this book has brought individual pool statistics and data up-to-date through the first two months of 1951.

Applied Sedimentation, *a symposium edited by Parker Trask. Published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price $5. Pages, 663.*

The primary aim of this book is to consider in detail the practical applications of sedimentation. Thirty-five articles by specialists in the field of geology and engineering are divided into seven parts. The book begins with an explanation of the basic principles of sedimentation, then details various applications, including one section on the problems of petroleum geology, others on economic mineral deposits, engineering problems, and military application.

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ASTM Standards On Gaseous Fuels, *prepared by Committee D-3 on Gaseous Fuels, published by American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania. Price, $1.75. Pages, 134.*

This second edition of ASTM Standards on Gaseous Fuels contains four new methods: Analysis of Natural Gases by the Volumetric-Chemical Methods, Analysis by the Mass Spectrometer, Water Vapor Content of Gaseous Fuels by Measurement of Dew-Point Temperatures, and Sampling Natural Gas. Information provided on the first method covers apparatus, reagents, sampling, procedure for absorption and combustion analysis, calculations, etc. Covered in the second method are principle of method, referenee standards, preparation of apparatus, etc. Topics included in the third and fourth methods terminology, testing procedures, and calculations.

Annual Review of California Crude Oil Production, *1950, published by Conservation Committee of California Oil Producers, 855 Subway Terminal Building, Los Angeles, California.*

Statistics relative to crude oil production in California and the activities of the Conservation Committee are given in the Annual Review. Crude oil production statistics, reserves and production comparisons, as well as development and exploratory drilling, new discoveries, and the natural gas situation are included. The geological section contains many maps and charts of the various fields and petroleum areas in California. The book discloses that California's share in the national output was 16.6 per cent, the lowest since 1941.

Symposium on the Texas "Tidelands" Case, *published by Baylor Law Review, Waco, Texas. Price, $1. Pages, 335.*

This collection of opinions by authoritative jurists gives an excellent legal background of the Supreme Court cases in which California, Louisiana, and Texas lost title to their marginal seas. The winter issue 1951 of the Baylor Law Review is devoted entirely to articles, papers, and documents pertaining to the "tidelands" decision. It is must reading for those who would understand the case and surprisingly easy reading considering legal basis of the papers.

Oil and Gas Directory, 1951, *published by Oil and Gas Directory, Inc., 504 Richmond, Houston 6, Texas. Price, $18. Pages, 410.*

The Directory contains the listings of over 61,000 businesses, their officials and key personnel, and the individuals engaged in the petroleum industry in over 425 towns and cities in Texas, Louisiana, Oklahoma, and New Mexico. Cross indexed for quick reference, company listings give name, address, telephone, officials, and key personnel; individual listings give name, position, home address, telephone numbers, employer and business address. The Directory offers free this year to subscribers a searcher service, which will give current data in answer to any inquiry made.

Geology of the Barilla Mountains, Texas, *by G. K. Eifler, Jr., and* **Pegmatites of the Van Horn Mountains,** *by Peter T. Flawn,* **Report of Investigations Nos. 8 and 9.** *Published by the Bureau of Economic Geology, University of Texas, Austin, Texas. Price, each 35 cents.*

"Geology of the Barilla Mountains, Texas," reprinted from the Bulletin of the Geological Society of America, April 1951, consists of 15 pages, with a geologic map of the area covered. A section on petrography, by Mrs. Kathryn O. Dickson is also included.

"Pegmatites of the Van Horn Mountains, Texas" is a 30-page reprint from Economic Geology, March-April, 1951. The booklet is well-illustrated with 14 figures, one of which is a map of the Mica Mine area.

Petroleum Facts and Figures, 1950. *Published by American Petroleum Institute, 50 West 50th Street, New York 20, N. Y. Price, $2.50. Pages, 468.*

This ninth edition (the first since 1947) stresses long term series of comparable tables on utilization, production, refining, marketing, transportation, prices, and taxes. These are complete historically so that it will not be necessary to refer back to earlier editions. The new tables on business, operating, and allied statistics, coupled with the historical information on the industry, resulted in an enlarged edition, to which supplements will be added annually for five years. At the end of that time, a new and completely revised edition will be made available.

Oil and Gas Leasing On the Public Domain, *by Lewis Edwin Hoffman. Distributed by F. H. Gower, First National Bank Building, Denver, Colorado. Price, $7. Pages, 415.*

For the many persons who have occasion to deal with oil and gas leases on federal lands, this book should serve as an extremely helpful textbook. Principally covered are the Mineral Leasing Act of 1920 and its numerous amendments. Some of the questions considered are: Non-competitive oil and gas leasing, processing of application, issuance of leases, simultaneous filings, royalty interests, bonds, options, and leases within known oil and gas producing fields. Also included as exhibits are the important laws, regulations, forms, orders, and decisions affecting the leasing of federal lands.